CHEST

Original Research

COPD

Chronic Bronchitis in Women Using Solid Biomass Fuel in Rural Peshawar, Pakistan*

Tasleem Akhtar, PhD; Zahoor Ullah, PhD; Mir Hassan Khan, PhD; and Rubina Nazli, MBBS, DGO

Background: **Biomass smoke has been associated with many diseases. The aim of this study was to evaluate the relationship between biomass smoke and chronic bronchitis in women in the rural setting of Peshawar, Pakistan.**

Methods: **Three villages in rural Peshawar were randomly selected as "test villages" where biomass fuel was used. The women responsible for cooking in these villages were interviewed for the prevalence of bronchitis, and data were compared to those obtained from three matching "control villages" where liquid petroleum gas was used as fuel. Crude odds ratios (ORs) and 95% confidence intervals (CIs) were calculated using a statistical software package (EPI Info, version 6.0 [public domain software]; Centers for Disease Control and Prevention; Atlanta, GA).**

Results: **This study was carried out in 1,426 female test patients and 1,131 female control subjects. Chronic bronchitis was found in 100 women (7.01%) in the test group and 33 women (2.92%) in the control group. The OR was 2.51 (95% CI, 1.65 to 3.83). A strong association was found between bronchitis and the use of wood (OR, 2.38; 95% CI, 2.12 to 3.01), dung cake (OR, 2.01; 95% CI, 1.72 to 2.42), rice straws (OR, 3.32; 95% CI, 1.11 to 9.88), and kai grass (OR, 1.96; 95% CI, 1.75 to 2.45). Cooking in the living room and bronchitis were highly associated (OR, 2.5; 95% CI, 1.94 to 3.66). An association between the presence of a kitchen and bronchitis was established with an OR of 2.65 (95% CI, 2.10 to 3.42). In the test group, 75% of kitchens were ventilated; in the control group, 82% were ventilated. The difference between the two groups was nonsignificant ($p > 0.6$; $\chi^2 = 0.39$; OR, 0.83; 95% CI, 0.5 to 1.4).**

Conclusions: **Biomass fuel exposure is strongly associated with chronic bronchitis in women who are involved in cooking in rural Peshawar.** ***(CHEST 2007; 132:1472–1475)***

Key words: biomass fuel; bronchitis; indoor pollution

Abbreviations: CI = confidence interval; OR = odds ratio

Biomass fuel is composed mainly of wood, animal dung, and crop residue. About 50% of the world population and 90% of rural communities in developing countries are using biomass as a single source of cooking fuel.[1]

Different studies have reported biomass smoke as a cause of acute upper and lower respiratory infection,[2,3] otitis media,[4] chronic bronchitis/obstructive airway diseases,[5–8] lung cancer,[9] asthma, pulmonary tuberculosis,[10] low-birth-weight babies,[11] cataracts,[12] and mouth/nasopharyngeal carcinoma.[13] These effects are attributed to respiratory irritants like oxides of carbon, nitrogen, and sulfur, and to unburned hydrocarbon particles and polycyclic organic compounds, including carcinogens such as benzo [α]-pyrene.[14]

In Pakistan, the majority of households in rural communities use biomass fuel for cooking and space heating. The type of fuel used has an important role in health and disease. This role gains further significance when cooking is done in the living room, which is a common practice in winter. This survey was conducted in three villages around Peshawar, where purified fuel is still not available and the families are exclusively using solid biomass fuel for

For editorial comment see page 1415

cooking food. An attempt has been made to test the hypothesis that there is a close association/relationship between the use of biomass fuel and chronic bronchitis in women who are responsible for cooking through a comparison with a control group from rural areas around Peshawar.

Materials and Methods

The study was conducted in three villages around Peshawar, Pakistan, from September 2003 to June 2004. The villages were selected by using a multistage stratified sampling design to obtain a representative sample. Test and control villages having comparable geographic locations, populations, and socioeconomic status were randomly selected because they respectively used biomass fuel and liquid petroleum gas exclusively. A total of 20% of the households were randomly selected and included in the study. Approval for the study was taken from the Institutional Ethical Review Committee of Khyber Medical College Peshawar. Female nonsmokers who were responsible for cooking in the family were interviewed after informed consent was given. All relevant information (*ie*, age, socioeconomic status, family size, marital status, presence of a kitchen, and type of fuel used by the household) were recorded. Age at marriage and period/time spent daily for cooking were also recorded.

Chronic bronchitis was defined using the criteria of the American Thoracic Society,[15] which state that bronchitis is a condition with chronic or recurrent excessive mucous secretion into the bronchial tree occurring on most days for the last 3 months of the year for at least 2 successive years. The effect of cooking smoke on the prevalence of bronchitis was determined. The results are presented in the form of odds ratios (ORs) with 95% confidence intervals (CIs), and were compared through the χ^2 test for the association of different parameters in the two groups. For statistical analysis, a statistical software package (EPI-Info, version 6.0) was used.

Results

A total of 2,557 women (test villages, 1,426 women; control villages, 1,131 women) were interviewed and investigated during this study. Different characteristics of the two groups are presented in Table 1.

A total of 93% of households in the rural test areas used solid biomass fuels for cooking, which included wood, kai grass, dung cake, bagasse, and wood saw dust. In control villages, liquid petroleum gas was used by 97% of households.

Chronic bronchitis was prevalent in 100 women (7.01%) in the test group and 33 women (2.92%) in the control group. The OR was 2.51 (95% CI, 1.65 to 3.83). The difference in the two groups was highly significant, with a Mantel-Haenszel χ^2 value of 21.44 and $p < 0.0001$. Chronic bronchitis increased with increases in the ages of the respondents in both groups. In the test group, chronic bronchitis was more prevalent (89%) in women > 30 years of age compared to those < 30 years of age.

A strong association was found between bronchitis in the respondents and the use of wood (OR, 2.38; 95% CI, 2.12 to 3.01), dung cake (OR, 2.01; 95% CI, 1.72 to 2.42), rice straws (OR, 3.32; 95% CI, 1.11 to 9.88), and kai grass (OR, 1.96; 95% CI, 1.75 to 2.45) in the test villages. The Student *t* test results were highly significant, with $p < 0.0001$ for all four of the categories of fuel used.

A total of 363 of the households (25.45%) in the test villages and 413 of the households (36.51%) in the control villages cooked in the living room. The mean period of cooking in both the test and control villages was 4 months per year. It was noted that 0.55% of respondents in the test villages and 5.84% of respondents in the control villages were used to cooking in the living room for 12 months. The difference in the two groups was highly significant ($p < 0.0001$; $\chi^2 = 41.5$; OR, 2.5; 95% CI, 1.94 to 3.66).

A kitchen was present in 41.6% of households in the test villages and 54.7% of households in the control villages. An association between the presence of a kitchen and bronchitis in respondents from test villages vs those from control villages was established with an OR of 2.65 (95% CI, 2.10 to 3.42) and a χ^2 value of 68.2. The difference in the two groups was highly significant ($p < 0.0001$).

In the test villages, a U-shaped stove was used in 79.7% of households, a triangularly shaped stove made of bricks was used in 15.9% of households, and a metallic angithi was used for burning wood saw dust in only 4.4% households. The difference between the two types of stoves (*ie*, U-shaped and triangularly shaped) for the history of bronchitis was nonsignificant ($p > 0.56$; $\chi = 0.28$; OR, 0.90).

The maximum period of cooking in 92% of respondents from test villages and 87% of respondents from control villages was up to 30 years. The majority of respondents in test villages (44%) and control villages (37%) had cooked in the kitchen for the last 11 to 20 years. The prevalence of bronchitis in women females who had cooked for a period < 10 years was 27.5%, compared to 72.5% among women who had cooked food for > 10 years.

*From the Pakistan Medical Research Council at Khyber Medical College, Peshawar, Pakistan.
The project was funded by the World Health Organization/Regional Office for the Eastern Mediterranean.
The authors have reported to the ACCP that no significant conflicts of interest exist with any companies/organizations whose products or services may be discussed in this article.
Manuscript received October 16, 2006; revision accepted April 26, 2007.

Correspondence to: Tasleem Akhtar, PhD, Pakistan Medical Research Council Research Center at Khyber Medical College, Peshawar NWFP 25000, Pakistan; e-mail: tasleemkmc@yahoo.com
DOI: 10.1378/chest.06-2529