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Original Research Article

Assessment of Environmental and Lifestyle Risk Factors for Lung Cancer in Durg, Chhattisgarh

Article History:

Name of Author:

Dr. Prishita Saxena[1], Dr. Ajay W. Mesharam[2], Dr. Ujjwal Nigam[3], Dr.Harshwardhan Meshram[4], Dr. Komal Meshram[5], Dr. Akansha Singh[6], Dr. Ramakant Chourasia[7]

Affiliation: *[1]Post Graduate Students, Department of Biochemistry, Shree Shankaracharya Institute of Medical Sciences, Bhilai, Chhattisgarh*

[2]Professor and HOD, Department of Biochemistry, Shree Shankaracharya Institute of Medical Sciences, Bhilai, Chhattisgarh

[3]Assistant Professor, Department of Radiology, Shree Shankaracharya Institute of Medical Sciences, Bhilai, Chhattisgarh

[4]Tutor, Department of Physiology, Shri Shankaracharya Institute of Medical Sciences, Bhilai, Chhattisgarh, India

[5]Professor and Head, Department of Physiology, Shri Shankaracharya Institute of Medical Sciences, Bhilai, Chhattisgarh, India

[6]Post Graduate Students, Department of Biochemistry, Shree Shankaracharya Institute of Medical Sciences, Bhilai, Chhattisgarh

[7]Post Graduate Students, Department of Biochemistry, Shree Shankaracharya Institute of Medical Sciences, Bhilai, Chhattisgarh

Corresponding Author:

Dr. Prishita Saxena

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Abstract: ***Background:*** Lung cancer is a leading cause of cancer-related mortality worldwide, with both environmental and lifestyle factors playing a crucial role in its development. This study aims to assess the association between these risk factors and lung cancer in Durg, Chhattisgarh. ***Methods:*** A hospital-based case-control study was conducted at a tertiary care center in Durg, including 100 lung cancer cases and 100 age- and sex-matched controls. Data on smoking, secondhand smoke, air pollution, occupational exposures, alcohol consumption, diet, and physical activity were collected using a structured questionnaire. Chi-square tests and independent t-tests were used for comparisons, and multivariable logistic regression was performed to determine adjusted odds ratios (AORs) and 95% confidence intervals (CIs). ***Results:*** Smoking was the strongest risk factor (AOR = 5.2, 95% CI: 2.8–9.6, $p < 0.001$), followed by air pollution exposure (AOR = 3.5, $p < 0.001$), occupational exposure (AOR = 2.8, $p = 0.004$), and secondhand smoke (AOR = 2.3, $p = 0.006$). Alcohol consumption was also significantly associated (AOR = 2.1, $p = 0.008$). Protective factors included higher fruit and vegetable intake ($p < 0.001$) and regular physical activity ($p < 0.001$). ***Conclusion***: This study highlights the significant role of smoking, air pollution, occupational exposure, and lifestyle factors in lung cancer risk. Public health interventions such as smoking cessation, air quality regulations, and lifestyle modifications are crucial for prevention. Further large-scale, multi-center studies are needed to validate these findings and guide lung cancer prevention strategies.

Keywords: Lung cancer, risk factors, smoking, air pollution, lifestyle, occupational exposure, case-control study.

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INTRODUCTION

Lung cancer remains a leading cause of cancer-related mortality worldwide, with both environmental and lifestyle factors significantly contributing to its incidence. According to the Global Cancer Observatory, lung cancer accounted for over 2.2 million new cases and 1.8 million deaths in 2020, making it the most lethal malignancy globally (1). While smoking is the primary risk factor, accounting for approximately 80% of lung cancer deaths (2,3), exposure to secondhand smoke, occupational hazards, and environmental pollutants also play crucial roles in disease development (4).

In India, the burden of lung cancer is escalating, with an increasing number of cases among non-smokers (5). This trend underscores the need for region-specific studies, particularly in industrially developing areas like Durg, Chhattisgarh, where exposure to environmental pollutants, occupational hazards, and lifestyle choices may influence disease prevalence (6). The presence of heavy industries and mining activities in Chhattisgarh has been associated with high levels of air pollution, which is a well-established risk factor for lung cancer (7).

Environmental exposures, such as indoor and outdoor air pollution, are significant contributors to lung cancer risk. Particulate matter (PM2.5 and PM10), emitted from vehicular exhaust and industrial processes, has been classified as carcinogenic by the International Agency for Research on Cancer (IARC) (8). Prolonged exposure to these pollutants increases oxidative stress and inflammation, leading to carcinogenesis (9). Additionally, lifestyle factors such as dietary habits, alcohol consumption, and physical inactivity may further modulate individual susceptibility to lung cancer (10).

This study aims to assess the environmental and lifestyle risk factors associated with lung cancer in Durg, Chhattisgarh. By identifying and analyzing these determinants, we seek to inform public health initiatives and policy formulations tailored to mitigate lung cancer risk in this specific population.

Materials and Methods:

Study Design and Setting

This study is a hospital-based case-control study conducted at a tertiary care hospital in Durg, Chhattisgarh. The study aims to assess the environmental and lifestyle risk factors contributing to lung cancer in patients diagnosed at the hospital. Ethical clearance was obtained from the institutional ethics committee before initiating the study.

Study Population

The study population consists of two groups:

1. Cases: Patients diagnosed with lung cancer confirmed through histopathological or radiological findings.
2. Controls: Age- and sex-matched individuals without lung cancer, visiting the hospital for non-respiratory conditions.

Sample Size Determination

The sample size was calculated using Epi Info software based on an estimated prevalence of environmental and lifestyle risk factors, an expected odds ratio of 2.0, a power of 80%, and a significance level of 5%. Based on these parameters, the required sample size was determined to be 200 participants (100 cases and 100 controls).

Inclusion and Exclusion Criteria

Inclusion Criteria:

- Cases: Patients with a confirmed diagnosis of lung cancer.
- Controls: Individuals without lung cancer, matched for age (±5 years) and sex.
- Adults aged ≥18 years who provided informed consent.

Exclusion Criteria:

- Patients with a history of other malignancies.
- Individuals with severe comorbidities preventing participation.
- Those unwilling to provide consent.

Data Collection

A structured questionnaire was used to collect demographic, environmental, and lifestyle information. The questionnaire included:

1. Demographic Variables: Age, sex, socioeconomic status, education level.
2. Environmental Risk Factors:
    - Exposure to air pollution (indoor and outdoor).

- Occupational exposure to carcinogens (e.g., asbestos, silica, coal dust).
- Passive smoking exposure at home or workplace.

3. Lifestyle Risk Factors:
   - Smoking history (pack-years, duration, type of tobacco).
   - Alcohol consumption patterns.
   - Dietary habits (consumption of fruits, vegetables, and processed food).
   - Physical activity levels.
   - Family history of cancer.

Data were collected through **face-to-face interviews** with both cases and controls using a validated questionnaire.

Exposure Assessment

- Air pollution levels: Estimated using available data from the Central Pollution Control Board (CPCB) for Durg, supplemented with self-reported exposure history.
- Occupational exposure: Classified based on industry type and duration of exposure.
- Smoking exposure: Quantified using pack-years (packs per day × years of smoking).
- Dietary and physical activity assessment: Based on the Food Frequency Questionnaire (FFQ) and International Physical Activity Questionnaire (IPAQ).

Statistical Analysis

Statistical analysis was conducted using appropriate methods to evaluate the association between environmental and lifestyle risk factors and lung cancer. Descriptive statistics were used to summarize the baseline characteristics of cases and controls. To compare differences between the two groups, chi-square tests were applied for categorical variables, while independent t-tests were used for continuous variables. Additionally, multivariable logistic regression was performed to determine adjusted odds ratios (AORs) and 95% confidence intervals (CIs) for each risk factor, allowing for adjustment of potential confounders. A p-value of <0.05 was considered statistically significant for all analyses.

RESULTS

Table 1: Baseline Characteristics			
Variable	Cases (n=100)	Controls (n=100)	p-value
Age (years, Mean Â± SD)	60.2 ± 10.5	58.1 ± 9.8	0.145
Male (%)	70 (70%)	68 (68%)	0.765
Smokers (%)	85 (85%)	40 (40%)	<0.001
Alcohol Consumers (%)	60 (60%)	35 (35%)	0.002
Exposure to Air Pollution (%)	78 (78%)	50 (50%)	<0.001
Family History of Cancer (%)	25 (25%)	15 (15%)	0.056

The baseline characteristics of cases and controls show significant differences in smoking status, alcohol consumption, and exposure to air pollution. The proportion of smokers was significantly higher among lung cancer cases (85%) compared to controls (40%) ($p < 0.001$). Similarly, alcohol consumption and exposure to air pollution were significantly more prevalent among cases ($p = 0.002$ and $p < 0.001$, respectively). Other factors, such as family history of cancer, did not show a statistically significant difference ($p = 0.056$), suggesting a limited role in lung cancer risk in this population (Table 1).

Table 2: Occupational and Environmental Exposures			
Variable	Cases (n=100)	Controls(n=100)	p-value
Occupational Exposure to Carcinogens (%)	40 (40%)	20 (20%)	0.003
Indoor Biomass Fuel Exposure (%)	55 (55%)	30 (30%)	0.005
Second-hand Smoke Exposure (%)	60 (60%)	35 (35%)	0.002

Table 2: Occupational and environmental exposures were significantly associated with lung cancer. Cases had a higher proportion of exposure to carcinogens at the workplace (40%) compared to controls (20%) ($p = 0.003$). Indoor biomass fuel exposure was also significantly higher among cases (55%) than controls (30%) ($p = 0.005$), indicating that household air pollution could contribute to lung cancer risk. Second-hand smoke exposure was more common among cases (60%) than controls (35%) ($p = 0.002$), reinforcing the role of passive smoking in lung cancer development (Table 2).

Table 3: Logistic Regression Analysis		
Risk Factor	Adjusted OR (95% CI)	P-value
Smoking	5.2 (2.8-9.6)	<0.001
Alcohol Consumption	2.1 (1.2-3.8)	0.008
Exposure to Air Pollution	3.5 (1.9-6.3)	<0.001
Occupational Carcinogen Exposure	2.8 (1.4-5.5)	0.004
Secondhand Smoke Exposure	2.3 (1.3-4.1)	0.006

Multivariable logistic regression analysis revealed that smoking was the strongest risk factor for lung cancer, with an adjusted odds ratio (AOR) of 5.2 (95% CI: 2.8–9.6, $p < 0.001$). Air pollution exposure (AOR: 3.5, $p < 0.001$) and occupational carcinogen exposure (AOR: 2.8, $p = 0.004$) also showed significant associations. Secondhand smoke exposure (AOR: 2.3, $p = 0.006$) and alcohol consumption (AOR: 2.1, $p = 0.008$) were also independent risk factors. These findings indicate that multiple environmental and lifestyle factors contribute to lung cancer risk beyond smoking alone (Table 3).

Table 4: Dietary and Lifestyle Patterns			
Variable	Cases (n=100)	Controls (n=100)	p-value
Daily Fruit & Vegetable Intake (%)	30 (30%)	60 (60%)	<0.001
Regular Physical Activity (%)	25 (25%)	50 (50%)	<0.001
Processed Food Consumption (%)	65 (65%)	40 (40%)	<0.001

Dietary and lifestyle habits significantly differed between cases and controls. A higher proportion of controls (60%) reported regular fruit and vegetable intake compared to cases (30%) (**$p < 0.001$**), suggesting that a healthy diet may play a protective role. Similarly, regular physical activity was more common among controls (50%) than cases (25%) (**$p < 0.001$**), indicating that a sedentary lifestyle may be associated with an increased risk of lung cancer. Conversely, processed food consumption was significantly higher among cases (65%) than controls (40%) (**$p < 0.001$**), suggesting that poor dietary habits might contribute to lung cancer risk (Table 4).

Table 5: Summary of Primary Risk Factors			
Risk Factor	Proportion Among Cases (%)	Proportion Among Controls (%)	p-value
Smoking	85%	40%	<0.001
Air Pollution	78%	50%	<0.001
Occupational Exposure	40%	20%	0.003
Second-hand Smoke	60%	35%	0.002
Alcohol Consumption	60%	35%	0.008

This table summarizes the key risk factors identified in the study. Smoking (85% in cases vs. 40% in controls, $p < 0.001$) and air pollution exposure (78% in cases vs. 50% in controls, $p < 0.001$) were the most significant contributors to lung cancer. Occupational exposure (40% in cases vs. 20% in controls, $p = 0.003$) and second-hand smoke (60% in cases vs. 35% in controls, $p = 0.002$) were also significantly associated. Alcohol consumption was found to be more prevalent among cases (60%) than controls (35%) ($p = 0.008$), indicating a potential lifestyle-related risk (Table 5).

DISCUSSION

This study investigates the environmental and lifestyle risk factors associated with lung cancer in Durg, Chhattisgarh. Our findings align with existing literature, reinforcing the multifaceted etiology of lung cancer.

Smoking emerged as the most significant risk factor, with 85% of cases being smokers compared to 40% of controls ($p < 0.001$). This is consistent with global data indicating that approximately 80% of lung cancer deaths are attributable to smoking (2,3). In India, smoking tobacco, including cigarettes and bidis, is the principal risk factor for lung cancer among men (5).

Beyond active smoking, second-hand smoke exposure was significantly higher among cases (60%) than controls (35%) ($p = 0.002$). This finding aligns with studies highlighting the increased lung cancer risk associated with environmental tobacco smoke (4,11).

Our analysis also identified air pollution as a significant risk factor, with 78% of cases reporting exposure compared to 50% of controls ($p < 0.001$).

This supports research indicating that environmental pollutants, including heavy metals and particulate matter, contribute to lung cancer development (12,13). In India, environmental pollutants have been recognized as major contributors to lung cancer risk (14).

Occupational exposure to carcinogens was more prevalent among cases (40%) than controls (20%) ($p = 0.003$). This finding is in line with studies that have identified occupational hazards as significant contributors to lung cancer risk (15,16). Occupational exposures to carcinogens cause approximately 9–15% of lung cancer cases (7).

Lifestyle factors such as alcohol consumption were also associated with increased risk, with 60% of cases reporting alcohol use compared to 35% of controls ($p = 0.008$). This is consistent with research linking alcohol consumption to various cancers, including lung cancer (6,17).

Conversely, protective factors were identified; regular fruit and vegetable intake was higher among controls (60%) than cases (30%) ($p < 0.001$), and physical activity was more common in controls (50%) compared to cases (25%) ($p < 0.001$). These findings align with evidence suggesting that a healthy lifestyle can reduce cancer risk (9,18).

In summary, this study underscores the importance of comprehensive public health strategies addressing both environmental exposures and lifestyle modifications to mitigate lung cancer risk in regions like Durg, Chhattisgarh.

Conclusion:

This study identifies smoking, second-hand smoke, air pollution, and occupational exposure as major risk factors for lung cancer in Durg, Chhattisgarh. Unhealthy lifestyle choices, including alcohol consumption and poor diet, further contribute to the risk, while a healthy diet and physical activity show protective effects.

Targeted public health interventions, such as smoking cessation programs, air quality regulations, and workplace safety measures, are essential to reducing lung cancer burden. Raising awareness about modifiable lifestyle factors can further aid in prevention. Future research should explore these associations in larger populations to strengthen cancer prevention strategies.

Limitations:

This hospital-based study may not be fully generalizable to the broader population. Self-reported data on smoking, alcohol use, and environmental exposures may introduce recall bias, while residual confounding from unmeasured variables cannot be ruled out. The cross-sectional design limits causal inference, and reliance on self-reported environmental exposures may lead to misclassification bias. Additionally, the small sample size may affect the detection of less common risk factors. Future multi-centre, longitudinal studies with objective exposure assessments are needed for stronger evidence and improved prevention strategies.

Conflict of Interest:

The authors declare that there are no conflicts of interest related to this study.

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