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Effects of Tobacco Dust on Cardiovascular and Pulmonary Health of Female Beedi Workers in Murshidabad District, West Bengal

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ABSTRACT

Background: Beedi rolling is one of the largest unorganized sectors in India, predominantly involving women. Chronic occupational exposure to tobacco dust affects cardiovascular and pulmonary health, but limited data exist in Murshidabad district of West Bengal.

Methods: A cross-sectional comparative study was conducted among 160 women: 80 female beedi workers (with 10–20 years of experience) and 80 age-matched healthy controls. Physiological measurements included Systolic Blood Pressure, Diastolic Blood Pressure, Pulse Rate, Oxygen Saturation (SpO_2), and Peak Expiratory Flow Rate (PEFR). A structured questionnaire was administered to capture demographic and occupational information.

Results: Beedi workers exhibited significantly elevated SBP (145.0 ± 2.9 mmHg), DBP (95.4 ± 3.2 mmHg), and Pulse Rate (104.5 ± 3.2 bpm), while PEFR (226.0 ± 14.8 L/min) and SpO_2 (95.9 ± 0.8%) were markedly lower compared to controls ($p < 0.001$).

Conclusion: Chronic exposure to tobacco dust significantly impairs cardiovascular and pulmonary functions among female beedi workers. Preventive strategies and health policies are urgently needed.

Keywords: *Beedi workers, Tobacco dust, Pulmonary health, Hypertension, Occupational health*

Introduction

India is among the largest producers and consumers of tobacco, with beedi production accounting for nearly 48% of the total tobacco consumption (Ramakrishnan et al., 2019). The industry employs approximately 4.4 million workers, mostly women from marginalized communities, who roll beedis at home or in small workshops (Mishra et al., 2014; Joshi et al., 2012).

Beedi rolling involves direct and prolonged contact with tobacco dust, which contains nicotine, nitrosamines, and polycyclic aromatic hydrocarbons (Bagwe & Bhisey, 1993; Bhisey et al., 1999). These toxic agents are absorbed through the skin and respiratory tract, leading to systemic health consequences (Umadevi et al., 2003; Rao & Reddy, 2017).

Previous studies have demonstrated increased prevalence of hypertension, anemia, respiratory impairment, and ocular problems among beedi workers (Mahimkar & Bhisey, 1995; Jain & Agarwal, 2011; Singh & Gupta, 2015). Lung function studies have revealed significantly reduced PEFR and FEV1 among exposed women, indicating obstructive and restrictive ventilatory defects (Pakhale et al., 2012; Sharma et al., 2020). Chronic exposure also reduces oxygen saturation levels, increasing the risk of hypoxemia (Pal & Das, 2022; Ghosh & Mitra, 2023).

Despite this evidence, limited data exist from Murshidabad district, West Bengal—one of India's largest hubs of beedi production. Therefore, this study was undertaken to evaluate cardiovascular and pulmonary parameters among Female Beedi Workers compared to healthy Controls.

Materials and Methods

Study Design and Setting

A cross-sectional comparative study was conducted between 2022 and 2024 in Beldanga-I Block, Murshidabad district, West Bengal, a region with high prevalence of beedi rolling (Ramakrishnan et al., 2019; Islam & Mondal, 2021).

Study Population

The study included 160 women:

Exposed Group: 80 female beedi workers with 10–20 years of occupational experience.

Control Group: 80 age-matched healthy women not involved in tobacco-related occupations.

Sampling

From four gram panchayats (Kapasdanga, Bhabta-I, Bhabta-II, and Mirjapur-I), 20 Female Beedi Workers and 20 normal healthy Female Non Beedi Workers (Controls) were selected using purposive random sampling, similar to previous occupational health studies (Umadevi et al., 2003; Poonam et al., 2010).

Inclusion Criteria

Women aged 25–55 years.

For exposed group: ≥10 years of beedi rolling.

Non-smokers, non-alcoholic, and without chronic systemic diseases.

Exclusion Criteria

Pregnant women.

Those with diagnosed asthma, tuberculosis, or COPD.

Data Collection Tools

1. Questionnaire: Pre-tested structured questionnaire collected socio-demographic, occupational, and health-related data (Mishra et al., 2014).

2. Physiological Measurements:

Blood Pressure: Measured thrice at 5-minute intervals using Doctor's Sphygmomanometer; average recorded (Mahimkar & Bhisey, 1995).

Fig 1: Measurement of Blood Pressure by Sphygmomanometer

Pulse Rate: Counted manually and cross-verified with pulse oximeter (Swami et al., 2006).

SpO_2: Measured using fingertip pulse oximeter (Pal & Das, 2022).

Fig 2 : Measurement of Oxygen saturation (%) through Pulse Oximeter

PEFR: Recorded using Peak Flow Meter; best of three attempts considered (Pakhale et al., 2012).

Fig 3 : Measurement of Peak Expiratory Flow Rate (PEFR) through Peak Flow Meter

Ethical Consideration

Written informed consent was obtained (signature/thumb impression). As the study involved only non-invasive procedures, separate institutional ethical clearance was not mandated (Mishra et al., 2014; Islam & Mondal, 2021).

Statistical Analysis

Data analyzed using SPSS v25. Mean ± SD calculated. Group differences assessed using independent t-test. $p < 0.05$ considered significant (Sharma et al., 2020; Srivastava & Dubey, 2019).

Results

Comparison of Physiological parameters between Female Beedi Workers and Healthy Controls (Normal Healthy Female Non Beedi Workers):

Parameter	Female Beedi Workers (Mean ± SD)	Healthy Controls (Mean ± SD)
Systolic BP (mmHg)	145.04 ± 2.95	117.35 ± 4.31
Diastolic BP (mmHg)	95.38 ± 3.25	77.86 ± 5.38
Pulse Rate (beats/min)	104.55 ± 3.27	82.22 ± 2.15
PEFR (Lit/min)	226.01 ± 14.89	397.39 ± 28.93
SpO_2 (%)	95.98 ± 0.83	98.39 ± 0.49

Table 1: Physiological Parameters in Beedi Workers and Healthy Controls

Female Beedi Workers had significantly higher mean SBP (145.04 ± 2.95 mmHg), DBP (95.38 ± 3.25 mmHg), and Pulse Rate (104.55 ± 3.27 bpm) compared to healthy Controls (117.35 ± 4.31 mmHg, 77.86 ± 5.38 mmHg, and 82.22 ± 2.15 bpm, respectively; $p < 0.001$).

Peak Expiratory Flow Rate (PEFR) was significantly lower among Female Beedi Workers (226.01 ± 14.89 L/min) compared to healthy Controls (397.39 ± 28.93 L/min, $p < 0.001$). SpO_2 was also reduced (95.98 ± 0.83% vs. 98.39 ± 0.49%, $p < 0.01$).

Discussion

This study demonstrates significant impairment in cardiovascular and pulmonary function among female beedi workers. Elevated blood pressure observed in this study corroborates previous findings of hypertension among tobacco-exposed populations (Jain & Agarwal, 2011; Singh & Gupta, 2015; Saha & Basu, 2022). Nicotine and tobacco dust cause sympathetic overactivity and vascular endothelial dysfunction, contributing to increased SBP and DBP (Swami et al., 2006; Kumar & Singh, 2018).

Tachycardia noted among workers aligns with earlier studies attributing it to nicotine-induced autonomic imbalance (Singh & Kumar, 2021; Rao & Reddy, 2017). Reduced PEFR indicates chronic obstructive ventilatory impairment, consistent with multiple reports on Female Beedi Workers (Pakhale et al., 2012; Sharma et al., 2020; Bandyopadhyay & Chatterjee, 2016; Chatterjee & Banerjee, 2022).

Low oxygen saturation among Female Beedi Workers suggests impaired gas exchange, possibly due to airway inflammation and chronic bronchitis (Pal & Das, 2022; Ghosh & Mitra, 2023). This hypoxemia increases cardiovascular risk and may contribute to long-term morbidity (Srivastava & Dubey, 2019; Agarwal & Jain, 2020).

Socioeconomic vulnerability further aggravates health risks. Beedi workers are often illiterate, poorly nourished, and lack healthcare access, consistent with findings from earlier social and occupational health studies (Mishra et al., 2014; Joshi et al., 2012; Islam & Mondal, 2021).

Preventive interventions—such as use of protective masks, workplace ventilation, health education, and alternative livelihoods—are urgently required (Sinha & Gupta, 2013; Choudhury & Pradhan, 2019).

Conclusion

Chronic exposure to tobacco dust among Female Beedi Workers in Murshidabad district significantly increases cardiovascular risks and impairs pulmonary function. Effective occupational health policies and socioeconomic upliftment strategies are crucial.

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Conflict of Interest

The author declares no conflict of interest.

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