Respiratory Disorders among Dust Exposed Workers

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ABSTRACT

Introduction: Exposure to dusts and hard physical work is common in developing industrialized countries. Acute and chronic respiratory illnesses are highly been reported from jute and textile industry. This study was undertaken to explore status of respiratory health among the workers of jute and textile industries.

Methods: This descriptive cross-sectional study enrolled 315 workers from each of textile and jute industry of Eastern Nepal. Almost all the workers were selected from the textile industry whereas those from dust prone areas of jute industry. Workers were interviewed using pre-tested questionnaires. Measurement of height, weight and peak expiratory flow rate was done.

Results: Majority were non-smokers in both the industries 230 (73%) in Jute vs. 223 (70.8%) in Textile. Most of the workers had the working experience of less than five years; jute 134 (42.5%) vs. textile 180 (57.1%). Upper respiratory disorder was found in more than 1/5 of workers (68) in jute vs. 1/20 of workers (18) in textile industry. One and two workers suffered from chronic bronchitis in the jute and the textile industry respectively. Chest tightness was reported among 4 (1.3%) in jute vs. 17 (5.4%) in textile workers, cough symptoms among 86 (27.3%) in jute vs. 26 (8.3%) in textile industry. Low practice of personal protective measure was seen in both industries. The mean score of PEFR of workers in jute mill was lower than the workers in textile industry.

Conclusions: Workers with acute respiratory disorders were more in the jute industry while chest tightness was more in the textile industry. Chronic respiratory problems did not appear to be alarming in both the industries. Use of personal protective measures should be promoted among the dust exposed workers.

Keywords: dust exposure; peak expiratory flow rate; respiratory disorder.

INTRODUCTION

Exposure to high levels of dusts among industrial workers is common in developing and newly industrialized countries. Pulmonary response to hazardous airborne particles at workplaces produces airway disorders. Occupational exposures to airborne particulates is estimated to cause 12% of deaths due to chronic obstructive pulmonary disease and occupational health is of major concern in the South-East Asia Region.
Asthma was suspected for individual workers in the jute industry. Informed consent was taken from the authorities of the industries to conduct the study. Consent was included in the study. Unit of the study was an individual worker.

Prior studies have shown that respiratory problems among workers (25.3%) in textile industry is more than among workers (16%) in jute mill.\textsuperscript{10,11} Sample size was calculated by taking the lower prevalence of respiratory problems among workers in jute mill industry i.e. 16%.\textsuperscript{10}

Sample Size was calculated by using the formula
\[ n = Z^2 pq/e^2 \]
where \( P \) is the prevalence of the reference study (\( p = 16 \)), \( q \) is the complement of \( p \), i.e., \( q = 100-p \), \( e \) is allowable error, which is taken to be 20% of \( p \) in this study and \( Z \) is the standard normal variate, which is 1.96 for 95% confidence interval. Hence, it gives us 525 sample size.

Adding 20% for non-responsive participants, the final sample size was 630 participants.

Equal number of participants was enrolled from the jute industry (315) and the textile industry (315). Almost all the workers were selected from the textile industry while the workers from the jute industry were selected from batching, spinning, weaving and drawing, which were supposed to have higher dust exposure. Consent was taken from authorities of the industries to conduct the study. Informed consent was taken from the participants.

Interview technique was applied to collect data by using pretested questionnaires. Measurement of height and weight was done. The weight of the workers was taken in minimum clothing and without shoes. Peak expiratory flow rate (PEFR) was measured by a vitalograph Peak expiratory flow meter. The purpose and technique of the test was explained to the study subjects followed by demonstrating the manoeuvre. The subjects were allowed to make two-practice attempts.\textsuperscript{12} An acceptable peak expiratory flow value was defined as the one that was produced with the hardest blow, after taking a maximum deep inhalation, as was interpreted on visual appearance. The highest of the three acceptable readings was recorded as the peak expiratory flow of the individual.

The predicted peak values of PEFR was calculated by the models for predicting peak expiratory flow rate (PEFR) which was developed for North Indian healthy population.\textsuperscript{13} Asthma was suspected for individual who’s PEFR was <80% predicated.\textsuperscript{14} Other features of asthma were enquired and suggested as per the need. Shortness of breath, wheeze and chest tightness were considered as lower respiratory tract symptoms. Chronic bronchitis was said when sputum production occurring on most (\( \geq 5 \)) days of a week for at least 3 months a year for at least 2 consecutive years. Chronic cough was said when cough without sputum for \( \geq 5 \) days a week for at least 2 consecutive years. Dyspnea was said when having to walks lower than a person of the same age at an ordinary pace on a level ground because of breathlessness. Analysis of data was done using Statistical Package for Social Sciences (SPSS, version 16.0).

## RESULTS

A total of 630 participants working in various departments or units of jute and textile industry were enrolled in the study. Higher proportions of workers were males in both the industries, 269 (85.4%) workers in jute industry and 301 (95.6%) workers in textile industry respectively. Majority of the workers were married, 261 (82.9%) workers in jute industry and 243 (77.1%) workers in textile industry. About 53 (16.8%) and 42 (13.3%) workers were illiterate in the jute and textile industry respectively (Table 1).

| Characteristics | Jute Industry (\( n = 315 \)) | Textile Industry (\( n = 315 \)) |
|-----------------|-----------------------------|----------------------------------|
| Gender          |                             |                                  |

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### METHODS

The descriptive cross-sectional study was designed to enroll workers from textile industry and jute industry in Dharan-Biratnagar Industrial Corridor of Nepal from August 2014 to March 2015. Ethical Approval was obtained from Institutional Ethical Review committee of BPKIHS. The subjects who were engaged in the industries and not working as trainees and giving consent were included in the study. Unit of the study was an individual worker.

The subjects followed by demonstrating the manoeuvre. The subjects were allowed to make two-practice attempts. An acceptable peak expiratory flow value was defined as the one that was produced with the hardest blow, after taking a maximum deep inhalation, as was interpreted on visual appearance. The highest of the three acceptable readings was recorded as the peak expiratory flow of the individual.

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| Characteristics | Jute Industry (\( n = 315 \)) | Textile Industry (\( n = 315 \)) |
|-----------------|-----------------------------|----------------------------------|
| Gender          |                             |                                  |
Table 2 shows that majority of workers were non-smokers in both the industries [230 (73%) vs. 223 (70.8%)]. Half of the workers in the industries had reported of chewing tobacco [152 (48.3%) vs. 145 (46%)]. Majority of the workers were not using personal protective equipment as mask to protect from dust at their workplaces in both the industries [261 (82.9%) vs. 238 (75.6%)].

Most of the workers had the working experience of less than five years in both the industries [134 (42.5%) vs. 180 (57.1%)]. There was no participant with working experience of more than 15 years in the jute industry where as about 36 (11.4%) workers had working experience of 15 to 20 years and 12 (3.8%) workers had working experience of more than 20 years in the textile industry (Table 3).

Table 4 shows the workers with their peak expiratory flow rate less or more than 80% of their predicted one. The proportion of workers having less than 80% of their predicted peak expiratory flow rate was far less in both the industries. About 26 (8.3%) and 23 (7.3%) workers produced the hardest blow to measure peak expiratory flow rate less than 80% of their predicted one in jute and textile industry respectively.

### Table 2. Personal habit of the workers in the jute and textile industry.

| Characteristics          | Jute Industry (n = 315) | Textile Industry (n = 315) |
|--------------------------|-------------------------|----------------------------|
|                          | n (%)                   | n (%)                      |
| Smoking Status           |                         |                            |
| Smoker                   | 65 (20.6)               | 90 (28.6)                  |
| Non Smoker               | 230 (73.0)              | 223 (70.8)                 |
| Ex-smoker                | 20 (6.3)                | 2 (0.6)                    |
| Tobacco                  |                         |                            |
| Marital status           |                         |                            |
| Unmarried                | 41 (13.0)               | 70 (22.2)                  |
| Married                  | 261 (82.9)              | 243 (77.1)                 |
| Divorced/Separated       | 5 (1.6)                 | 1 (0.3)                    |
| Widowed                  | 8 (2.5)                 | 1 (0.3)                    |
| Religion                 |                         |                            |
| Hinduism                 | 287 (91.1)              | 303 (96.2)                 |
| Buddhism                 | 4 (1.3)                 | 4 (1.3)                    |
| Muslim                   | 10 (3.2)                | 4 (1.3)                    |
| Kirat                    | 14 (4.4)                | 4 (1.3)                    |
| Literacy status          |                         |                            |
| Illiterate               | 53 (16.8)               | 42 (13.3)                  |
| Primary                  | 101 (32.1)              | 70 (22.2)                  |
| Lower Secondary          | 88 (27.9)               | 67 (21.3)                  |
| Secondary                | 53 (16.8)               | 80 (25.4)                  |
| Higher Secondary and above | 20 (6.3)        | 56 (17.8)                  |
| Age category (years)     |                         |                            |
| Less than 20             | 20 (6.3)                | 35 (11.1)                  |
| 20 to 30                 | 139 (44.1)              | 107 (34.0)                 |
| 30 to 40                 | 102 (32.4)              | 88 (27.9)                  |
| 40 to 50                 | 48 (15.2)               | 54 (17.1)                  |
| 50 to 60                 | 6 (1.9)                 | 26 (8.3)                   |
| 60 and above             | -                       | 5 (1.6)                    |

Table 3. Distribution of workers according to their working experience in the industries.

| Working Experience (years) | Jute Industry (n = 315) | Textile Industry (n = 315) |
|----------------------------|-------------------------|----------------------------|
|                            | n (%)                   | n (%)                      |
| Less than 5                | 134 (42.5)              | 180 (57.1)                 |
| 5 to 10                    | 105 (33.3)              | 53 (16.8)                  |
| 10 to 15                   | 76 (24.1)               | 34 (10.8)                  |
| More than 20               | -                       | 12 (3.8)                   |

Table 4. Categorization of workers with their peak expiratory flow rate (PEFR).

| PEFR                          | Jute Industry (n = 315) | Textile Industry (n = 315) |
|-------------------------------|-------------------------|-----------------------------|
|                               | n (%)                   | n (%)                       |
| < 80% predicted PEFR          | 26 (8.3)                | 23 (7.3)                    |
| ≥ 80% predicted PEFR          | 289 (91.7)              | 292 (92.7)                  |

Distribution of workers according to respiratory
Disorders in the jute and textile industry is shown (Table 5). Cough was reported by more than one-fourth of workers in the jute industry while it was reported by less than one-tenth of workers in the textile industry. Upper respiratory disorder was prevalent among more than one-fifth of workers in the jute industry while it was prevalent around one twentieth of workers in the textile industry.

| Respiratory Disorders | Jute Industry (n = 315) n (%) | Textile Industry (n = 315) n (%) |
|-----------------------|-------------------------------|---------------------------------|
| Cough                 | 86 (27.3)                     | 26 (8.3)                        |
| Throat Pain           | 15 (4.8)                      | -                               |
| Upper Respiratory Problem | 68 (21.6)                  | 18 (5.7)                        |
| Difficulty in Breathing | 16 (5.1)                     | 6 (1.9)                         |
| Chest tightness       | 4 (1.3)                       | 17 (5.4)                        |
| Chronic Bronchitis    | 1 (0.3)                       | 2 (0.6)                         |
| Cough with sputum     | 21 (6.7)                      | 5 (1.6)                         |
| Asthma                | -                             | 1 (0.3)                         |
| Tuberculosis          | -                             | 1 (0.3)                         |

Difficulty in breathing, representing lower respiratory tract symptoms was prevalent among 16 (5.1%) workers in the jute industry while it was prevalent among 6 (1.9%) workers in the textile industry. As much as 4 (1.3%) and 17 (5.4%) workers in the jute and textile industry reported chest tightness as lower respiratory tract problem respectively. Only one worker was diagnosed as chronic bronchitis in the jute industry. Two workers were diagnosed as chronic bronchitis in the textile industry.

Table 6 shows the difference of means of PEFR of workers with respect to type of industry, gender and use of personal protective equipment. Mean score of PEFR of workers in jute mill was lower than the workers of textile industry. Likewise, means of PEFR of workers was higher among males than females; PPE users than non-users at work place.

| Characteristics | Category | Mean PEFR | SD       |
|-----------------|----------|-----------|----------|
| Height category (cm) | <150 | 41 381.71 | 75.990 |
|                 | 150-155 | 62 427.26 | 80.697 |
|                 | 155-160 | 151 481.92 | 108.577 |
|                 | 160-165 | 183 508.03 | 96.837 |
|                 | 165-170 | 136 518.97 | 91.839 |
|                 | ≥ 170   | 57 580.70 | 124.440 |
| Total           | 630     | 494.54   | 109.002 |
| Weight category (kg) | <45 | 83 417.83 | 90.595 |
|                 | 45-55   | 235 484.17 | 99.878 |
|                 | 55-65   | 199 515.18 | 103.547 |
|                 | 65-75   | 83 525.06 | 105.869 |
|                 | ≥75     | 30 566.67 | 142.909 |
| Total           | 630     | 494.54   | 109.002 |
| Age category (years) | <20 | 55 501.82 | 90.351 |
|                 | 20-30   | 246 496.26 | 114.449 |
|                 | 30-40   | 190 485.05 | 103.866 |
|                 | 40-50   | 102 491.37 | 105.070 |
|                 | 50-60   | 32 525.31 | 131.615 |
|                 | ≥60     | 5 558.00 | 122.760 |
| Total           | 630     | 494.54   | 109.002 |

Increase in means of PEFR of workers was seen according to the increase in height, and weight. However, the means of PEFR also increased with age except in category 20-30 years (Table 7).

Table 7. Comparison of PEFR of all the workers by height, weight and age.
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