ORIGINAL ARTICLE ASIAN JOURNAL OF MEDICAL SCIENCES

Comparative analysis of respiratory health profile among female beedi and non-beedi workers in a district of West Bengal

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Submission: 17-02-2021 Revision: 23-05-2021 Publication: 01-07-2021

ABSTRACT

Background: Beedi workers are more prone to develop chronic respiratory diseases over time. **Aims and Objectives:** The present research aimed to investigate and compare the respiratory health profile and the factors associated among the beedi workers and non-beedi workers. **Materials and Methods:** An analytical, community based, cross sectional study was conducted among 60 female beedi and non-beedi workers. Multistage sampling was used to select three wards out of twenty wards under a municipality of the study district. After interview with a pre-designed structured questionnaire, the respondents were examined clinically and pulmonary function test was done using a portable spirometer. **Results:** All beedi workers were married and 23.3% were illiterate. Most of them had 1to 10 years exposure. Half of them initiated their work between 11 to 20 years. Rate of tobacco smoking, obesity, hypertension, asthma, diabetes was high among beedi workers. Forced Vital Capacity, Forced Expiratory Flow 25-75 and Peak Expiratory Flow Rate were significantly more among non-beedi workers. Forced Expiratory Volume in 1st second was more among non-beedi workers but FEV1/FVC ratio was same for both the group. **Conclusion:** Significantly better respiratory health profile of non-beedi workers have reflected beedi binding as a reason behind chronic respiratory disease. Therefore, awareness generation session regarding occupation based adverse effects and safety measures must be conducted at regular interval to make the working condition favorable.

Key words: Female beedi workers; Pulmonary function test; Chronic respiratory diseases

Access this article online

Website: http://nepjol.info/index.php/AJMS

DOI: 10.3126/ajms.v12i7.34818

E-ISSN: 2091-0576

P-ISSN: 2467-9100

INTRODUCTION

India is the third largest producer and sixth largest exporter of tobacco.[1] It is estimated from the annual survey of industries (1997-1998) data that almost 85% of employees of tobacco manufacturing industries are employed in the beedi industry. Since beedi rolling is largely considered to be a cottage industry, it generates much more employment at the manufacturing stage.[2] BP Chattopadhyay et al.,[3] concluded in the study conducted in Murshidabad, West Bengal, that the respiratory symptoms were found higher in beedi workers compared to control subjects. A trend of decrement of lung volumes with the duration of work exposure was observed. The pulmonary function abnormalities found among the male beedi workers were obstructive, restrictive and 'combined restrictive and obstructive' type.[3] It is a known fact, tobacco dust contains harmful substance like Nitrosamines which get absorbed in lungs and mucous membrane of mouth, nose, and intestine.[4] Studies have shown that nicotine levels in the bodily fluids of beedi workers increased largely.[5] A comparative study conducted in Patna, India and studied the health problems of 197 female beedi rollers to ascertain the effects of beedi rolling on health. The study found that more than 70% of the respondents suffered from respiratory problems including COPD and asthma, while more than 40% of the beedi rollers suffered from eye, gastrointestinal and nervous problem sand more than 25% of the respondents faced osteological

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problem. Workers showed a significantly higher prevalence of wheezing, attacks of shortness of breath with wheezing, dyspnea etc. Thus the study concluded that beedi rolling may cause significant health hazards, especially respiratory diseases like COPD.[6] As it is seen that beedi workers are very much prone for occupational asthma which can be diagnosed by a non-invasive simple test like pulmonary function test. Burge and coworkers using the combination of history and specific challenges as the gold standard, the sensitivity of visual analysis of PEF (peak expiratory flow) monitoring varied from 77% in colophony-induced occupational asthma to 100%in isocyanate induced asthma.[7] A large population living in the district of 24 north 24 parganas in West Bengal, earns their living by beedi binding. The mortality and morbidity associated with tobacco use is mainly due to respiratory diseases moreover tobacco is a risk factor for tuberculosis and for death from tuberculosis.[8] Therefore, it is worth exploring the idea of respiratory and other impairment associated with chronic exposure. In the recent study, we did Pulmonary Function Test (PFT) using spirometry as a tool to measure respiratory morbidity of beedi workers in the study area.

The advantages of using PFT as a diagnostic tool are that, PFT can be done to assess patients' lung function outside the laboratory in a natural setting, at work, and at home. It is simple and non-invasive and thus it is useful in differentiating between non occupational asthma and work related asthma; relationship between asthma and workplace.[9]

In India, majority of beedi binders were usually female and belonged to unorganized sector leading to unprotected labor. Women's involvement in beedi rolling has been linked to the ease of learning the skill, its manual operations, the fact that work can be carried out at home and soon. However, there are references to women and children being better at the job, especially girl children. According to government estimates, beedi rolling employs nearly 50 lakh beedi workers in the country, of whom 70 to 80 per cent are women and children.[10,11] Moreover, this work is so poorly paid that some never break the cycle of poverty that locks them into unhealthy lives.[5]

Therefore, we aim to investigate the respiratory health profile among the female beedi and non-beedi laborers in a district of West Bengal and also to find out the association between the working status and respiratory morbidity among them.

MATERIAL AND METHODS

An observational analytical study with cross sectional design was planned among the beedi workers and non-beedi workers of the study area after receiving the Institutional ethical clearance. The study area was in different wards of Kalyani municipality under Nadia district, West Bengal, India. The research was conducted for a period of twelve months, three months for proposal, six months for collection of data and three months for analysis and report writing. The current study included two groups, first group included adult female beedi workers and other groups had adult female population not involved with beedi work. The study included only those permanent resident (more than six months) beedi workers who were working in the beedi industry for at least one year or more. The pregnant females, having reported past history of acute myocardial infarction, pulmonary embolism, heart failure, any abdomino-thoracic, head and neck or cataract surgery in last six week were excluded from the research.[12] Sample size was calculated was 30 in each group after multiplying with design effect of 2. Multistage sampling was to select three wards out of twenty wards under Kalyani Municipality. Sampling frame of female beedi workers were prepared by line listing in each ward with help of medico-social workers of department of Community Medicine. From each ward, 10 female beedi workers were selected using simple random sampling and 10 female members of subsequent household who were not engaged in beedi production were selected after satisfying inclusion and exclusion criteria. On the days of survey, households of beedi makers and non- beedi makers were visited. The nature and purpose of the study with associated risks and benefits were described in details individually to the participants, confidentiality of their information was assured and written consent was obtained. Participants were interviewed by a pre-designed pre-tested structured questionnaire. Then participants were examined clinically and anthropometric measurement was carried out as per standard operative procedure. [13] Spirometric examination was carried out using an auto- calibrated portable spirometer (RMS Helios 702) in sitting posture as per standard method.[14] Ethnic correction using Indian predicted equation and temperature correction were done by software provided with Spirometer. Respiratory health profile of respondents were assessed by FVC (% of predicted value), FEV_1 (% of predicted value), FVC/FEV_1, FIVC, FEF 25-75 (% of predicted value) and PEFR (% of predicted value).

Ethics

At first, the study proposal was presented before scientific review committee of the institution and modified according to the directive of the governing body of the same. The modified research proposal was again sent to Institutional Ethics Committee (IEC) for the final permission. After obtaining the permission of IEC the study was conducted.

Statistical analysis

All collected data were compiled in MS Excel and checked for consistency and completeness. Data was analyzed using statistical software (licensed SPSS 22.0). Some of the responses were recoded and analyzed. For descriptive statistics, mean, median, inter quartile range, standard deviation and proportion were used. Mann-whitney test was used to look for association. Multiple box plot was used to show the comparison of distribution of different spirometry parameters among Beedi and non-Beedi workers. P value of <0.05 was considered as significant.

RESULTS

Socio-demographic profile

The present study had a total of 60 respondents. One-third of the beedi workers belonged to the age group of 35-39 years, while two-third of the non-beedi workers belonged to the 20 -29 years age group. The mean (SD) age of beedi and non-beedi workers was 35.97(8.16) and 26.63(5.37) years respectively. All beedi workers were married while two-third (66.7%) of non-beedi workers were married. Nearly one in every three non-beedi workers were graduate. Illiteracy rate was 13.3% among non-beedi workers. Two-third of the beedi workers belonged to lower middle class as per modified BG Prasad scale [January, 2020].[15] In this study, 36.7% of the beedi workers were smokers, but none of the non-beedi workers were smoking tobacco. Overcrowding was present in 33.4% of beedi workers.

Occupational profile

The study that around two third (66.7%) of beedi workers rolled 401-600 beedi per day with mean [SD] beedi rolled per day was 510 and around 53.3% of them had 1-10 years expousure and 30% beedi workers had 11-20 years exposure. Around half [53.3%] of the beedi workers were initiated their work in between 11-20 years and one third [33.3%] beedi workers contributed 1501-2000 INR in their family with mean [SD] contribution 1403.33 [768.11] (Table 1).

Reported morbidity profile

Majority (70%) of beedi workers reported high blood pressure. One-fifth (20%) beedi workers had asthma. Nearly one-fourth (26.7%) beedi workers had diabetes. One of them had history of tuberculosis (3.3%). None of non-beedi workers reported any co-morbidity. The proportions of overweight and obesity among beedi workers were 33.3% and 10.0% respectively. Around half [55%] of study participants had normal BMI (Table 2). Wheeze was found among four (13.3%) beedi workers. Pallor was seen among 6.7% beedi workers and 3.3% non-beedi workers.

Table 1: Occupational attributes (n=30)

Attributes	Number (%)	Descriptive Statistics
Beedi rolling per day		
200-400	6 (20.0)	**Mean (SD)=** 510 (194.94)
401-600	20 (66.7)	**Median (IQR)=** 500 [500, 500]
601-800	1 (3.3)	**Range=2**00-1000
800-1000	3 (10.0)	
Duration of exposure (years)		
1 – 10	16 (53.3)	**Mean (SD) =**13.55 (9.02)
11-20	9 (30.0)	**Median (IQR) =** 10 (5-20)
21-30	4 (13.3)	**Range=1**-35
>= 31	1 (3.4)	
Total	30 (100)	
Age of initiation (years)		
<11	1 (3.3)	**Mean (SD) =**22.20 (6.33)
11-20	16 (53.3)	**Median (IQR)=**
21-30	11 (36.7)	20.00 (18.75 – 25.00)
31-40	2 (6.7)	**Range=1**0 – 40
Total	30 (100)	
Monthly family contribution (Rs.)		
<= 500	4 (13.3)	**Mean (SD) =**1403.33 (768.11)
501-1000	9 (30.0)	**Median (IQR)=**
1001-1500	5 (16.7)	1350 [1000-2000]
1501-2000	10 (33.3)	**Range=0**0-3000
> 2000	2 (6.7)	
Total	30 (100)	

Comparative analysis of respiratory health profile

The median Forced Vital Capacity (in percentage of predictive value) was more among non-beedi workers [89.87] compare to non-beedi workers [77.04] and the difference was statistically significant (P = 0.003). The median Forced Expiratory Volume in 1st second was more among non-beedi workers [96.19] than the beedi workers [90.68]. However, this difference was not statistically significant (P=0.315). Both median Forced Expiratory Flow 25-75 and Peak Expiratory Flow Rate was more among non-beedi workers [117.25 and 99.66 respectively] than the beedi workers [91.28 and 74.55]. The difference was found to be statistically significant (P= 0.006 and P=.001) in both cases. In the current study, the median Forced Inspiratory Vital Capacity was significantly more among non-beedi workers [2.04] in respect with beedi workers [1.66] (P= 0.007). It was also seen, that, the median FEV1/FVC ratio was same [0.99] among both the study groups (Table 3) (Figure 1).

DISCUSSION

The present observational study was carried among 60 adults female beedi and non-beedi workers residing in the wards of a district of West Bengal. There were thirty workers in each group.

The respondents were aged between 20 to 49 years; with majority were less than 35 years of age. The mean (SD) age of study population was 31.30(8.31) years. All beedi

Table 2: Prevalence of overweight/obesity among study population (n=60)

BMI category [kg/mt^2]	Beedi workers n = 30 Number (%)	Non beedi workers n = 30 Number (%)	Total n = 60 Number (%)
Underweight [<18.5]	3 (10.0)	4 (13.3)	7 (11.7)
Normal [18.5 – 24.9]	14 (46.7)	19 (63.3)	33 (55.0)
Overweight [25-29.9]	10 (33.3)	6 (20.0)	16 (26.7)
Obesity [≥ 30]	3 (10.0)	1 (3.3)	4 (6.6)
Total	30 (100)	30 (100)	60 (100)

Table 3: Comparative Analysis of Respiratory health profile (n=60)

FVC (% of predictive value) among Beedi workers and non-Beedi workers				
Descriptive statistics	**Beedi workers (n=30)**	**Non beedi workers (n=30)**	**Total (n=60)**	**P value ***
Mean (SD)	78.55 (16.27)	99.48 (36.74)	89.02 (30.08)	0.003
Median (IQR)	77.04 (67.42 – 85.40)	89.87 (80.06 – 100.36)	82.12 (72.84 – 94.73)	
Range	55.80 – 127.72	55.36-200.82	55.36 – 200.82	
FEV1 (% of predictive value) among Beedi workers and non-Beedi workers				
Descriptive statistics	**Beedi workers (n=30)**	**Non beedi workers (n=30)**	**Total (n=60)**	**P value ***
Mean (SD)	93.86 (20.29)	97.77 (15.98)	95.82 (95.82)	0.315
Median (IQR)	90.68 (80.89 – 105.26)	96.19 (93.81 – 97.97)	95.96 (88.38 – 100.47)	
Range	52.84-0.151.76	70.22 – 147.02	52.84 – 151.76	
FEF 25-75 (% of predictive value) among Beedi workers and non-Beedi workers				
Descriptive statistics	**Beedi workers (n=30)**	**Non beedi workers (n=30)**	**Total (n=60)**	**P value***
Mean (SD)	91.01 (32.72)	123.45 (41.97)	107.23 (40.73)	0.006
Median (IQR)	91.28 (65.78 –113.93)	117.25 (88.01 –144.95)	100.66 (83.86 –126.14)	
Range	23.33 – 148.88	76.41 – 200	23.33 – 200	
PEFR (% of predictive value) among Beedi workers and non-Beedi workers				
Descriptive statistics	**Beedi workers (n=30)**	**Non beedi workers (n=30)**	**Total (n=60)**	**P value ***
Mean (SD)	74.56 (20.84)	97.89 (23.31)	86.23 (24.87)	0.001
Median (IQR)	74.55 (61.79 – 95.46)	99.66 (91.41 – 114.30)	93.13 (66.78 –103.43)	
Range	29.24 – 104.46	53.33 – 127.25	29.24 – 127.25	
FIVC among Beedi workers and non-Beedi workers				
Descriptive statistics	**Beedi workers (n=30)**	**Non beedi workers (n=30)**	**Total (n=60)**	**P value ***
Mean (SD)	1.61 (0.33)	1.83 (0.38)	1.71 (0.37)	0.007
Median (IQR)	1.66 (1.36 – 1.85)	2.04 (1.65 – 2.06)	1.73 (1.38 – 2.05)	
Range	1.04 – 2.39	1.15 – 2.50	1.04 – 2.50	
FEV1/FVC ratio among Beedi workers and non-Beedi workers				
Descriptive statistics	**Beedi workers (n=30)**	**Non beedi workers (n=30)**	**Total (n=60)**	**P value ***
Mean (SD)	0.95 (0.08)	0.95 (0.15)	0.95 (0.12)	0.833
Median (IQR)	0.99 (0.94 – 1.00)	0.99 (0.84 – 1.03)	0.99 (0.89 – 1.00)	
Range	0.66-1.00	0.69 – 1.45	0.66 – 1.45	

***Mann Whitney U test**

workers were Hindus. Illiteracy rate among beedi workers was 23.3%. Among the literates, 73.4% had studied up to primary level only. As per modified BG Prasad scale [January, 2020], 61.3% of study subjects belonged to Class IV and Class V.[15] In a study done among the 52 beedi workers residing in the urban slums of Mumbai had all Hindu female workers the mean (SD) age (45±8) years) and illiteracy rate (42.31%) were more than our study respondents. The reason for more illiteracy may be due to living in urban slums. Among literates, 48.08% and 9.62% had studied till secondary and primary level respectively. According to Modified BG Prasad classification, 42.31% and 25% belonged to class IV and class III respectively.[16] A cross sectional study from similar study settings of West Bengal had 103 all Hindu, female beedi workers. The mean age (38.69 years) of the beedi workers was nearly

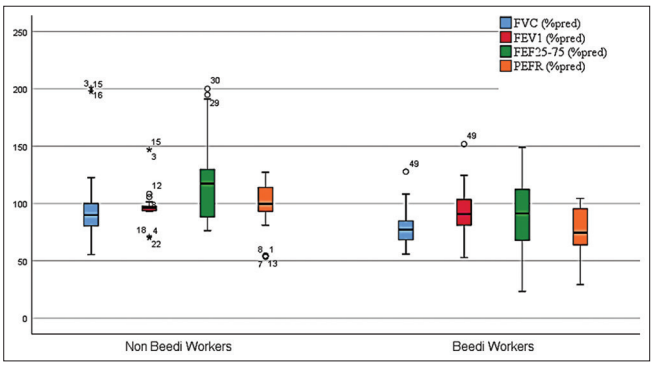

Figure 1: Multiple box plot showing comparison of distribution of different spirometry parameters (in percentage of predictive value) among Beedi and non-Beedi workers.
Higher median of FVC, FEF 25 -75 and PEFR was noted among non-beedi workers compared to beedi workers. Median FEV1 was similar in both groups. Several outliers were noted in both groups.

same with the mean age of current study's beedi workers (35.97 years). The illiteracy rate was found high (40.77%) in previous research from similar settings. Present research had overcrowding in 33.4% houses of beedi workers, similar with the earlier study.[17]

In our study, two-third of beedi makers rolled between 400 to 600 beedi per day. Among the workers, more than half had exposure varied between one to ten years and nearly one-third more than ten years exposure to this industry. More than half [53.3%] had started beedi rolling at the age of 11 to 20 years. One worker even started at the age of 7 years. Mean age of starting beedi rolling was 22.20 years in the present study. In the urban slum study from Mumbai, it was seen that, around 48.08% had started rolling at the age of 11 to 15 years. Two of them had started at 5 years. Maximum age of initiating rolling was 30 years. Mean years of service was 30 years. Women work on an average for eight hours. Number of beedis rolled was between 500 to 1000 per day. Around 75% of the women make 1000 beedi per day. (16) The study from similar area of West Bengal showed that, more than half (57.28%) started beedi rolling in the age range 15 to 25 years, nearly similar to our study. The maximum and minimum age of initiation was 50 and 6 years, respectively. The average number of beedi rolled per day was quite similar (571 vs. 510) to our study.[18]

In the present study, more than two-thirds of beedi workers reported high blood pressure. Asthma was a complaint for 20% beedi workers. Diabetes was also reported by 26.7% workers. None of non-beedi workers reported any co-morbidity. The proportions of overweight and obesity among beedi workers were 33.3% and 10.0% respectively. West Bengal study from similar settings revealed, dull aching headache was the most common symptom followed by lower back pain, neck pain, difficulty in vision, palpitation. More than half workers had lower limb weakness. Pallor was noted in 19.4% workers, three times more than present study. More than one-third was in pre hypertension stage. Isolated systolic and diastolic hypertension was recorded in 16.50%) and 4.85% respectively. Overweight and obesity was present 44.66% and 13.59% of beedi workers.[17] Most common morbidity was weakness and fatigue followed by lower backache. [16] The prevalence of pallor reported was too less than the South India study (19.41% vs. 40%).[18] The proportion of beedi workers with high BP in a study from West Bengal was similar to current study.[19]

Past literature suggested high burden of moderate respiratory problems among beedi workers. Chattopadhyay et al. found that diminished FVC, FEV1, FEF 25-75 and PEFR values similar to our study among male beedi binders with moderate to high burden of restrictive (5.9%), obstructive (11.8%) and mixed pattern (5.9%) of chronic respiratory diseases.[3] Annalaxmi et al.,[2] noticed nearly two-fifth had respiratory symptoms like cold. Mukhopadhyay et al.,[8] found that nearly half (53.4%) of beedi workers were suffering from respiratory illnesses among which 39.7% had COPD and 24.4% had TB.[8] But in our study, we found no one with pure obstructive type illness, one (3.3%) had mixed type and majority (63.4%) had pure restrictive type illness. No one had severe chronic respiratory illness. However nearly half (46.7%) mild and one-fifth (20.0%) had moderate disease. Low prevalence of obstructive disease despite of significantly diminished PEFR and FEF25-75 value denotes early changes in small airways which might not contributed to a clinically significant level of obstruction during expiration. This can be justified with relatively lower age predisposition of study subjects which might not allowed enough alveolar damage by the prolonged exposure of those deadly toxins from tobacco. Significantly decreased vital capacities like FIVC and FVC can be attributed to increased airway resistance due to immediate bronchoconstriction effect and central nervous system mediated apnea causing effect of nicotine during occupational exposure of tobacco dust.[20] High burden of non-communicable diseases like hypertension (70%), diabetes (26.7%), asthma (20%) were also noted among them which could be attributed to cardiovascular and metabolic effect of nicotine.[20] Hegde et al.,[21] Banu et al also found beedi workers had significantly poor outcome in spirometry in terms of FVC, FEV1, FEF25-75 compared to controls like the present study.[21,22] This result was supported by findings of Zhang et al, Ghosh et al. and Abdel Rasoul et al.[23-25] Most of the studies showed concomitant findings with present study however slight differences of prevalence of morbidities were noticed which might be a local variation.

CONCLUSION

The present study revealed the poor socioeconomic condition as well as unfavourable working environment of female beedi rollers of the study district. Poverty, illiteracy, poor pay package, prolonged exposure without any personal protective equipment, overcrowding created vicious cycle of poor quality of life of these workers. High prevalence of diabetes, high blood pressure and fatigue was observed among beedi workers. More than half of respondents have pure restrictive type of respiratory illness with moderate decrease of the respiratory parameters. Therefore, there is an absolute need to impart health education regarding the work and working environment related adverse effects and the beneficial effects of personal protective measures. An alternative source of livelihood must be sought out for these people by the policy makers.

ACKNOWLEDGEMENT

The authors want to thank Mrs. Papia Das, health worker of the urban field practice area and all the respondents for their whole hearted support for this study.

REFERENCES

1. Das J, Moitra S and Bhor M. Health Mapping of Women and Children Biri Binders of Block I and Block II of District Bankura, West Bengal, India. International Journal of Emerging Technology and Advanced Engineering. 2013; 2: 138-142.
2. Annalakshmi T. Health assessment in women beedi rollers in melapalayam, tirunelveli [Internet] [PhD Thesis]. Manonmaniam Sundaranar University; 2013 [cited 2020 Oct 20]. Available from: http://hdl.handle.net/10603/36794
3. Chattopadhyay B, Kundu S, Mahata A and Jane S. A study to assess the respiratory impairments among the male beedi workers in unorganized sectors. Indian Journal of Occupational and Environmental Medicine. 2006; 10:69-73.
   https://doi.org/10.4103/0019-5278.27303
4. Whitehead TP, Havel C, Metayer C, Benowitz NL and Jacob P. Tobacco Alkaloids and Tobacco-specific Nitrosamines in Dust from Homes of Smokeless Tobacco Users, Active Smokers, and Non-tobacco Users. Chem Res Toxicol. 2015; 28:1007-1014.
   https://doi.org/10.1021/acs.chemrestox.5b00040
5. International Labour Organisation. ILO's Pilot Action Project for Beedi Women Workers in India [Internet]. India; 2003 p. 15. Report No.: INT/02/M57/NET. Available from: https://www.ilo.org/wcmsp5/groups/public/---asia/---ro-bangkok/---sro-new_delhi/documents/projectdocumentation/wcms_125467.pdf
6. Yasmin S, Afroz B, Hayat B and D'Souza D. Occupational Health Hazards in Women Beedi Rollers in Bihar, India. Bull Environ Contam Toxicol. 2010; 85:87-91.
   https://doi.org/10.1007/s00128-010-0037-6
7. Moscato G, Godnic-Cvar J, Maestrelli P, Malo JL, Burge PS and Coifman R. Statement on self-monitoring of peak expiratory flows in the investigation of occupational asthma. Subcommittee on Occupational Allergy of the European Academy of Allergology and Clinical Immunology. American Academy of Allergy and Clinical Immunology. European Respiratory Society. American College of Allergy, Asthma and Immunology. Eur Respir J. 1995; 8:1605-1610.
8. Mukhopadhyay P, Sen S, Mondal G, Banerjee A, Chakraborty S. Risk of Respiratory Diseases Associated with Beedi Workers of North 24 Parganas in West Bengal, India. Int J Curr Res. 2015; 7: 20607-20610.
9. Ranu H, Wilde M and Madden B. Pulmonary Function Tests. Ulster Med J. 2011; 80:84-90.
10. Rustagi P, Srivastave P, Bhardwaj P, Saha M, Vyas A and Shree M. Survey of Studies on Beedi Industry with Special Emphasis on Women and Child Labour [Internet]. [cited 2020 Nov 2]. Available from: https://www.cwds.ac.in/wp-content/uploads/2016/11/survey_studies_beedi_industry.pdf
11. Bagchi J and Mukhopadhyay A. (1996) 'Child Labour in Beedi Industry: Murshidabad District in West Bengal: Report of Survey Conducted in two Blocks of the Murshidabad District' (sponsored by the Ministry of labour, Government of India), Calcutta: School of Women's Studies, Jadavpur University.
12. Miller MR, Crapo R, Hankinson J, Brusasco V, Burgos F, Casaburi R, et al. General considerations for lung function testing. Eur Respir J. 2005; 26(1):153-161.
    https://doi.org/10.1183/09031936.05.00034505
13. International Institute for Population Sciences, Mumbai, MInistry of Health and Family Welfare, Government of India. Clinical Anthropometric Biochemical (CAB) Manual [Internet]. 2014 [cited 2019 Sep 13]. Available from: http://rchiips.org/NFHS/NFHS4/manual/NFHS-4%20Biomarker%20Field%20Manual.pdf
14. O'Connor T and Manning P. Spirometry: Performance and Interpretation, A Guide for General Practitioners [Internet]. Irish Thoracic Society; 2005 [cited 2019 Sep 20]. Available from: https://irishthoracicsociety.com/wp-content/uploads/2017/05/SpirometryGuidelinespdf.pdf
15. Debnath DJ and Kakkar R. Modified BG Prasad Socio-Economise Classification, Upddated 2020. Indian Journal of Community Health. 2020; 32: 124-125.
    https://doi.org/10.47203/IJCH.2020.v32i01.024
16. Sabale RV, Kowli SS and Chowdhary PH. Working condition and health hazards in beedi rollers residing in the urban slums of Mumbai. Indian J Occup Environ Med. 2012; 16:72-74.
    https://doi.org/10.4103/0019-5278.107075
17. Basu G, Sarkar D, Pal R, Roy SK and Dasgupta R. Morbidity Audit of Women Beedi Workers in an Urban Fringe of West Bengal, India. Journal of Clinical and Diagnostic Research. 2018; 12: 5-9.
    https://doi.org/10.7860/JCDR/2018/31226.11265
18. Thomas RA, Cheriamane DC and Irfan A. A cross sectional study on health profile of female beedi rollers in a rural area in Mangalore. IOSR J Dent Med Sci. 2015; 14(12):10-14.
19. Mukherjee M, Goswami A, Mazumdar D and Pal B. A study on health profile of beedi workers in West Bengal, India. Int J Adv Res Manag Soc Sci. 2014; 3(8):17-25.
20. Mishra A, Chaturvedi P, Datta S, Sinukumar S, Joshi P and Garg A. Harmful effects of nicotine. Indian J Med Paediatr Oncol. 2015; 36:24-31.
    https://doi.org/10.4103/0971-5851.151771
21. Hegde MV, Ajith S and Shetty K. A Study to Evaluate Respiratory Symptoms and Lung Function Impairment in Beedi Workers and Usefulness of Protective Mask in Reducing Respiratory Symptoms. Int J Physiother Res. 2015; 3:986-991.
    https://doi.org/10.16965/ijpr.2015.120
22. Banu K, Sitalakshmi R and Padmavati R. Pulmonary Functions

among Beedi Rolling Workers of South India - A Cross Sectional Study. Int J Biomed Adv Res. 2014; 5:31-34.

https://doi.org/10.7439/ijbar.v5i1.477

23. Zhang Y, Chen J, Chen Y, Dong J, Wei Q and Lou J. Environmental Mycological Study and Allergic Respiratory Disease among Tobacco Processing Workers. J Occup Health. 2005;47: 181-187.

https://doi.org/10.1539/joh.47.181

24. Ghosh T and Barman S. Respiratory Problems of Workers in the Zarda Industry in Kolkata, India. Int J Occup Saf Ergon. 2007; 13:91-96.

https://doi.org/10.1080/10803548.2007.11076712

25. Abdel Rasoul GM, El-Sobky MK, Michael AA, El Dalatony MM and Lucchini R. Respiratory disorders among workers in a tobacco factory. Egypt J Occup Med. 2010;34 :255-266.

https://doi.org/10.21608/ejom.2010.725

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Source of Funding: None, **Conflict of Interest:** None