



OCCUPATIONAL HEALTH HAZARDS AND POSTURE ANALYSIS OF THE BEEDI WORKERS OF MURSHIDABAD DISTRICT, WEST BENGAL

Physiology

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ABSTRACT

In India, beedi is the most popular tobacco smoking product to the socio-economically backward people due to its very low price. Beedi acquires more than 85% market share of all tobacco products. Nearly 5 million workers are engaged in this beedi making job which makes it the 2nd largest agro-forestry industry of the country. More than 90% workers engaged in this job are women and children of villages. They don't have proper training and knowledge about the job and they do this job in addition with their daily household activities which makes them more vulnerable in this occupation. These beedi workers are suffering from various types of occupational health problems along with work related musculoskeletal disorders. Majority of them are suffering from lower back and knee pain due to prolonged sitting with forward bending of the back with knees bend position. Practicing of correct working postures in addition with job awareness, proper training, maintain of work-rest cycle, and suitable working environment may help to reduce the risk factors of occupational health hazards among these beedi making workers.

KEYWORDS

Beedi workers, Occupational health hazards, Work related musculoskeletal disorders, OWAS, REBA

INTRODUCTION

Tobacco smoking causes near about 1 million deaths worldwide per year in which 70% are in the age group of 30 to 69 years [1]. This will also lead to premature deaths of more than 50 million smokers whose are currently alive [2]. In India, beedi is the most common tobacco smoking product. Due to its very low price, it is the most popular tobacco smoking product among the socio-economically poor population and it has a current market share of about 85% [3]. Beedi is made by dried tobacco (0.20 to 0.25 grams) which is wrapped in a dried tendu leaf piece and is tightens by a thread.

This beedi industry was grown as organized sector but due to various government rules, regulations, strategies, as well as taxation on organized sector, it slowly shifted to unorganized sector [4]. In India, this beedi industry provides employment to about 4.9 millions of socio-economically backward class people which make it the 2nd largest agro-forestry industry of the country [5]. But the actual number of the workers might be more than 10 million [6]. In this industry, more than 90% workers are women and children which are due to their precise beedi rolling proficiency [7]. They engage in this job by contact (pieces per day) base system in which they can easily work from their homes. In addition to the burden on smokers, this industry creates a notable health risks for the beedi making workers particularly for women and children. According to International Labour Organization (2001), beedi making workers suffer from postural discomfortability, abdominal pain, eye problems, bronchial problems, T.B., problems during menstrual cycles (excess bleeding, irregularities and pain), anaemic disorders, as well as dizziness due to long time exposure to tobacco dust [8].

Most of these beedi industries are located in Andhra Pradesh, Madhya Pradesh, Maharashtra, Odisha, Karnataka, Uttar Pradesh and West Bengal [9]. In West Bengal, beedi making industry flourished in some parts due to large number of easily available cheap labours [10] and near about two million workers are involved in this home-based job [11]. Women and children are more familiar to the beedi making job due to their thin fingers which is required for beedi rolling process [12]. They don't have proper education and skill for other jobs and other source of income, and they also preferred this extremely strenuous job as it can easily be done from their homes in addition with their daily household activities [13]. But due to poor socio-economic family conditions, more than 3 lakh child workers are engaged in this hazardous beedi making occupation [14, 15].

These beedi workers are exposed in various types of occupational health hazards due to prolonged exposure to tobacco dust [16]. Mohandas also observed that these workers suffered from different occupational diseases and postural disorders due to prolonged

repetitive working postures [17]. Several research studies have also reported about the hazardous occupational risk factors present in this beedi making job [18-21]. So, in this present study an attempt is made to find out different types of occupational health hazardous present among the beedi making workers.

OBJECTIVES OF THE STUDY

The objectives of the study are to find out different occupational health hazards and work related musculoskeletal disorders (WRMSDs) among the beedi workers.

MATERIALS AND METHODS

Study area and subject selection: Sixty two (42 female and 20 male) beedi workers of Suti block of Murshidabad district, West Bengal are randomly selected for this study. The objectives of the present study are clearly explained to all the subjects (Layman terms).

Physical and Physiological parameters:

Height and weight of the subjects are measured by anthropometric scale and weighing machine (Crown weighing machine, India). Body mass index (BMI) is calculated by using standard formula [22]. Workers' blood pressures (systolic and diastolic) at resting state are measured by sphygmomanometer (Diamond, India) and stethoscope (Diamond, India). Resting heart rate is also measured by beats per minute count method from the carotid artery.

Survey questionnaire:

A modified Nordic questionnaire is used to survey the WRMSDs and job details of the workers [23]. The survey sheet had multiple choice questions with optional multiple choice answers and the communication was done through the local language.

Working postures analysis:

Different beedi making postures are recorded by video recording process (iPhone 14 pro max, USA). The working postures are analysed by OWAS (Ovako Working Posture Analysis System) [24] and Rapid Entire Body Assessment (REBA) method [25].

Body Parts Discomfort (BPD) scale:

Pain or discomfortability of the workers is analyzed by 10 point BPD scale in which 1-3, 4-6, 7-8 and 9-10 indicates mild, moderate, severe and very severe pain respectively.

Statistical Analysis:

SPSS 3.5 version is used to analysis the mean, standard deviation (SD value), odd ratio (OR) and 95% confidence interval (95% CI).

RESULTS AND DISCUSSION

Sixty two (42 female and 20 male) randomly selected beedi workers'

data are analyzed. Table 1 shows the physical and physiological parameters of these workers. Age of the subjects varies from 10 to 70 years where it is found that the average age of the female beedi workers is 31.9 years and male beedi workers is 49.7 years. It is observed that majority of the workers (73.6%) are below 40 years of age in case of female beedi workers. It is seen from the table that the average BMI of female and male beedi workers are 23.0 and 20.9 kg/m². It is also noticed that 14% female and 15% male workers fall under the low BMI category which may be due to lack of proper nutritional diet. It is also observed from the data that 14.28% and 7.14% female workers have systolic blood pressure <100 mm of Hg and >140 mm of Hg whereas 28.54% and 11.90% of them have diastolic blood pressure <70 mm of Hg and >90mm of Hg respectively. In case of male workers, it is also found that 45% workers have systolic blood pressure >140 mm of Hg whereas 25% workers have diastolic blood pressure >90mm of Hg. Abnormalities in systolic and diastolic blood pressure are noted which may indicate the poor diet with high physical as well as mental stress among them. Rao (2020) also reported in his study that beedi workers suffer from hypertension and malnutrition problems [26].

Table 1: Physical & Physiological Parameters Of Beedi Workers

Parameters	Female (n=42) (Mean ± SD)	Male (n=20) (Mean ± SD)
Age (years)	31.9 ± 15.40	49.7 ± 12.59
Weight (kg)	50.5 ± 9.1	54.4 ± 7.9
Height (cm)	148.2 ± 6.2	161.5 ± 5.3
BMI (kg/m ²)	23.0 ± 3.6	20.9 ± 2.5
Low (<18.5)	06 (14%)	03 (15%)
Normal (18.5-24.9)	24 (57%)	17 (85%)
High (≥ 25)	12 (29%)	00 (00%)
Systolic pressure (mm Hg)	115.4 ± 15.1	142.3 ± 21.3
Diastolic pressure (mm Hg)	75.6 ± 10.2	86.6 ± 7.8
Heart rate (beats/min)	90.5 ± 7.2	94.3 ± 11.5
SpO ₂	99.2 ± 0.7	98.9 ± 0.6

Female and male workers have 17.8 and 32.1 years of average working experience in this job and average duration of the work is more than 6 hours per day. In this present study it is found that most of the workers are suffering from work related musculoskeletal disorders (WRMSDs) which are aroused from their work.

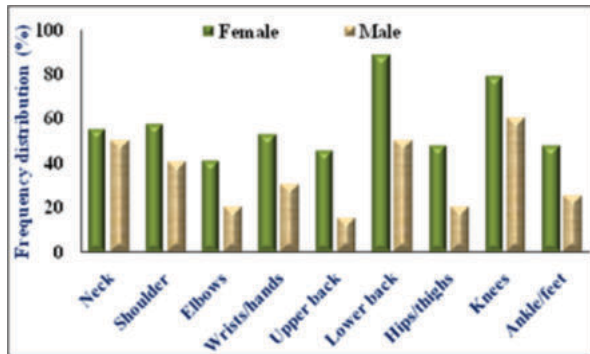


Figure 1: WRMSDs In Different Body Parts

WRMSDs in different body parts of the workers are shown in Figure 1 and it is found that 88.1% and 78.5% female workers are suffering from lower back pain and knee pain followed by shoulder, neck, wrist/hand, thigh, feet, upper back and elbow pain. In case of male workers, it is seen that 60% and 50% workers are suffering from knee and lower back pain followed by neck, shoulder, wrists, ankle, elbow and thigh pains. Joshi *et al.*, (2013) had reported that beedi workers (Andhra Pradesh) suffer from shoulder pain followed by back and neck pain [27]. This present study is also supported by the research results of Latha (2018) [28]. Rathore and Ugargol (2018) also observed that beedi workers suffer from various types of musculoskeletal disorders [28].

A comparison of WRMSDs between female and male workers are done and illustrated in Table 2. It is seen from the table that significant risks are present in case of upper back pain (OR 4.6812, 95% CI 1.19-18.41) and thigh pain (OR 3.6364, 95% CI 1.03-12.71) whereas highly significant risk is present in case of lower back pain (OR 7.4000, 95% CI 2.05-26.63). When compared with other parameters related to job between female and male beedi workers, it is observed that highly significant risk is found in case of severe body pain (OR 12.000, 95%

CI 2.46-58.46) whereas significant risks are also present in absenteeism (OR 4.2000, 95% CI 2.46-58.46) and activity reduction scenario (OR 3.6364, 95% CI 1.03-12.71). It is also observed that significant WRMSDs risk is present in female workers having up to 30 years of working experiences (OR 6.2500, 95% CI 1.28-30.34).

Due to prolonged forward bending of the back with both knees bend postures, most of them are suffering from lower back pain as well as knee pain. From the BPD scale, it is observed that 26% female and 13% male workers felt very severe or intolerable pain whereas 36% female and 22% male workers claimed to have severe body pain. 28% and 33% of female and male workers are also felt mild to medium body discomfortability due their present occupation (Figure 2).

Table 2: Odd Ratio (OR) Between Female And Male Workers

	No of workers (Female/male)	OR	95% CI	p-value
MSDs in different body parts				
Neck	23/10	1.2105	0.41-03.51	0.725
Shoulder	24/08	2.0000	0.67-05.90	0.209
Elbow	17/04	2.7200	0.77-09.56	0.118
Wrist	22/06	2.5667	0.82-07.96	0.102
Upper back	19/03	4.6812	1.19-18.41	0.027*
Lower back	37/10	7.4000	2.05-26.63	0.002**
Hip/ thigh	20/04	3.6364	1.03-12.71	0.043*
Knee	33/12	2.4444	0.76-07.79	0.130
Ankle/Feet	20/05	2.7273	0.83-08.87	0.095
Other parameters related to the job				
Severe pain	24/02	12.000	2.46-58.46	0.002**
Absenteeism	27/06	4.2000	1.33-13.21	0.014*
Reduce activity	20/04	3.6364	1.03-12.71	0.043*
Eye sight status	17/11	0.9273	0.30-02.84	0.895
Hearing status	12/06	0.9333	0.29-02.99	0.907
Fatigue	18/11	1.7500	0.56-05.44	0.333
MSDs and work experience				
≤ 30 years	30/06	6.2500	1.28-30.34	0.023*
> 30 years	08/08	0.3333	0.01-09.39	0.519

p < 0.05* (significant); p < 0.005** (highly significant)

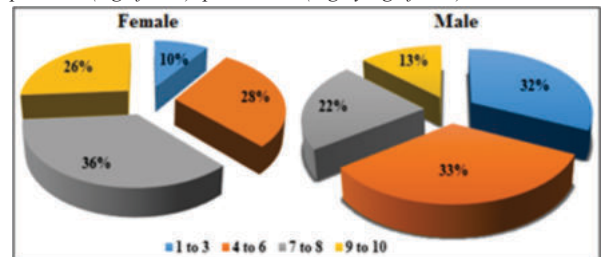


Figure 2: Frequency Distribution (%) of BPD scale

Table 3: Posture Analysis With Stick Diagram Of Female Workers By OWAS & REBA



Table 4: Posture Analysis With Stick Diagram Of Male Workers By OWAS & REBA

Fifteen different beedi making postures of female workers are analyzed by OWAS and REBA in this study (Table 3). Ten out of fifteen working postures are found in action category 2 (AC 2) which indicate that these postures are slightly harmful for the musculoskeletal system of the workers when analyzed by OWAS as there have been several limitations in this posture analysis method. Five out of fifteen working postures fall in the action category 1 (AC 1) of OWAS which indicates no harmful effect on musculoskeletal system of the workers. But when these postures are analyzed by REBA, it is observed that 46.66% working postures fall in the high risk levels (REBA score 8-10) which indicate it's harmful effects on the musculoskeletal system, whereas 33.33% postures also fall in the very high risk level with REBA score of 11-15 due to awkward/wrong trunk flexion, neck flexion, sitting with knees flexion (>60°) and lower arm flexion.

Eight different beedi making posture of male workers are analyzed by OWAS and REBA in this study and illustrated in Table 4. Four out of eight working postures are found in action category 2 (AC 2) which indicates that these postures are slightly harmful for the musculoskeletal system of the workers when analyzed by OWAS. Again 50% working postures fall in the action category 1 (AC 1) of OWAS which indicates no harmful effect on musculoskeletal system of the workers. But when analyzed by REBA, it is shown that 62.5% working postures fall in the high risk levels (REBA score 8-10) which indicate its harmful effects on the musculoskeletal system of the male workers whereas 37.5% postures fall in the very high risk level with REBA score of 11-15 due to awkward/wrong trunk flexion, neck flexion, sitting with knees flexion (>60°) and lower arm flexion. It is also recommended that these high risks harmful postures need to be further assessed and changed as soon as possible for minimize WRMSDs of the beedi making workers.

These beedi workers maintain different awkward working postures during their beedi making process and it is the main reason for the prevalence of work related musculoskeletal disorders among them. This result is also supported by Iti (2018) which stated that various MSDs particularly severe pain on vertebral column due to prolonged awkward working postures were found among beedi rolling workers [30]. It has also been reported by Shing *et al.*, (2018) that majority of the beedi workers suffer from body pain due to monotonous and repetitive nature of the job [31]. In this present study, absenteeism and reduced activity of the beedi workers due to the WRMSDs are also observed.

CONCLUSIONS

Female beedi workers belong to poor socio-economic conditions and are doing the beedi making job with addition to their all family responsibilities and household duties whereas some male beedi workers involve permanently in this beedi making job. These workers are suffering from various occupational health related issues due to improper working schedule, poor working site as well as lack of education, awareness, proper training, and periodic medical interventions. Most of the female workers felt very tired after day long beedi making job in addition with their strenuous household activities which makes them more vulnerable in this occupation.

These beedi workers maintain different types of awkward postures during the beedi making process which is the main reason for their WRMSDs. Majority of them are suffering from lower back and knee pain due to prolonged sitting with forward bending of the back with knees bend positions. They are also suffering from shoulder, neck, wrist/hand, thigh, feet and elbow pain every day. Awkward postures can be modified by practice to reduce trunk flexion, neck flexion, sitting with knees flexion (>60°) and lower arm flexion. Sitting support in all types of bending work in beedi making process may have a positive impact in lowering the risk of musculoskeletal disorders. Few low-cost ergonomic interventions such as working bench/chair and back support will improve the working postural quality. In addition, awareness to proper working postures, use of personal protective equipments, maintain of work-rest schedule, and suitable working environment may help to reduce the risk of occupational health hazards among these beedi making workers.

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REFERENCES

- Jha, P., Jacob, B., Gajalakshmi, V., *et al.* (2008), "A nationally representative case-control study of smoking and death in India." *New England Journal of Medicine*, 358 (11), 37-47.
- John, R. M., Rao, R., Rao, M., *et al.* (2010), "The economics of tobacco and tobacco taxation in India, Paris: International Union against Tuberculosis and Lung Disease, 2010." http://global.tobaccofreekids.org/files/pdfs/en/India_Tobacco_Economics_full_en.pdf.
- Lal, P. G., and Wilson, N. C. (2012), "The perverse economics of the Bidi and Tendu trade." *Economic and Political Weekly*, 40(07), 77-80.
- Mangasuli, V., and Sherkhane, M. S. (2016), "Utilization pattern of social welfare schemes among women beedi workers in comparison with non-beedi workers." *International Journal of Community Medicine and Public Health*, 3, 3266-3270.
- Lok Sabha, Unstarred Question No 4357 to be answered on 22.03.2021.
- Nandi, A., Ashok, A., Guindon, G., Chaloupka, F., and Jha, P. (2015), "Estimates of the economic contributions of the beedi manufacturing industry in India." *Tobacco Control*, 24(4), 369-375.
- Rustagi, P., Srivastava, P., Bhardwaj, P., Saha, M., Vyas, A., and Shree M. (2001), "Survey of studies on Beedi Industry with special emphasis on women and child Labour." 1-18.
- ILO (2001), "The beedi sector in India: an overview- improving working conditions and employment opportunities for women workers in beedi industry, Mangalore, Karnataka, India." *International Labour Organization*, 2001.
- John, S. (2008), "Culture of Bidis in India: Production, Employment, Marketing and Regulations." *Bidi Smoking and Public Health* (Eds. Gupta P. C., Asma), New Delhi, Ministry of Health and Family Welfare, Government of India.
- Burman, P. N. I. (2018), "Beedi Industry in Murshidabad District of West Bengal: An Empirical Study." *Business Studies*, 39 (1 & 2), 125-138.
- Singh, J. K., and Singh, P. (2015), "Occupational Exposure and Health Risks in Women Beedi Workers in India: A Review." *The International Journal of Humanities and Social Studies*, 3(10), 45-53.
- Ansari, M. S., and Raj, A. (2014), "Socio-Economic Status of Women Beedi Workers in Bundelkhand Region of Uttar Pradesh: An Empirical Analysis." *Journal of Economics*, 6(1), 53-66.
- Pande, R. (2007), "Women's work in the beedi industry in India." *Women in Nation Building - A Multi dimensional perspective*, Publisher: Panchajanya Publications, Hyderabad, 7-34.
- Dube, Y., and Mohandoss, G. (2013), "A study on child labour in Indian Beedi industry." *Agenda*, 6, 7. (Retrieved from http://www.softtown.in/aplabour/ documents /child_labour/Child_Labour_In_India_Beedi_Industry.pdf).
- Tucker, L. (1996), "The small hands of slavery: bonded child labor in India." *Human Rights Watch*.
- Biswas, G. (2023), "Occupational health hazards of beedi industry workers – A review." *International Journal of Scientific Research*, 12(8), 1-3.
- Mohandas, M. (1980), "Beedi Workers in Kerala: Conditions of Life and Work", *Economic and Political Weekly*, 15(36), 1517-1523.
- Bagwe, A. N., and Bhisey, R. A. (1991), Mutagenicity of processed beedi tobacco: possible relevance to beedi workers." *Mutation Research*, 261(2), 93-99.
- Kuruvila, M., Mukhi, S. V., Kumar, P., Rao, G. S., Sridhar, K. S., and Kotian, M. S. (2002), "Occupational dermatoses in Beedi rollers." *Indian Journal of Dermatology, Venereology and Leprology*, 68, 10-12.
- Kumar, N. S., and Bharathi, P. S. (2010), "A study on occupational health hazards among women beedi rollers in Tamilnadu, India." *International Journal of Current Research*, 11(1), 117-122.
- Pandian, S. H., and Duraisingh, V. (2021), "Occupational Health Hazards among Women Beedi Workers in Srivaikuntam Taluk of Thoothukudi District." *Turkish Online Journal of Qualitative Inquiry*, 12(3), 3017-3028.
- Keys, A., Fidanza, F., Karvonen, M. J., Kimura, N., Taylor, H. L. (1972), "Indices of relative weight and obesity." *Journal of Chronic Disease*, 25(6), 329-343.
- Dickinson, C.E., Campion, K., Foster, A.F., Newman, S.J., O'Rourke, A.M.T. and Thomas, P.G. (1992), "Questionnaire development: an examination of the Nordic musculo-skeletal questionnaire." *Applied Ergonomics*, 23, 197-201.
- Karhu, O., Kansi, P. and Kuorinka, I. (1977), "Correcting working postures in industry: A practical method for analysis." *Applied Ergonomics*, 8, 199-201.
- Hignett, S., and McAtamney, L. (2000) "Rapid entire body assessment (REBA)." *Applied Ergonomics*, 31(2), 201-205.
- Rao, L., Chelimeela, D., Kakkar, R., and Aravindakshan, R. (2020), "Occupational Morbidity of Women Beedi Workers in Telangana." *Indian Journal of Occupational Environmental Medicine*, 24(2), 78-83.
- Joshi, K.P., Robins, M., Venu, P. and Mallikarjunaih, K. M. (2013), "An epidemiological study of occupational health hazards among bidi workers of Amarchinta, Andhra Pradesh." *Journal of Academia and Industrial Research*, 1(9), 561-564.

- [28] Latha, R. (2018), "A study on the socio-economic status of women beedi workers in Tirunelveli district, Tamilnadu." *Review of Research*, 7(4), 1-6.
- [29] Rathore, A., and Ugargol, P.A. (2018), "Beedi rolling and the health hazards associated with occupational exposure: A situational review from Karnataka, India." *RGUHS National Journal of Public Health*, 4(1), 10-18.
- [30] Burman, P., and Iti, N. K. (2018), "Beedi Industry in Murshidabad District of West Bengal: An Empirical Study." *Business Studies*, 39(1 & 2), 125-138.
- [31] Singh, M., Amiri, M., and Sabbarwal, S. (2018), "Socio-economic, Health and Working Conditions of Child Beedi Rollers in Beedi Industry." *Journal of Social Science Studies*, 5(1), 239-247.