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A CROSS-SECTIONAL STUDY ON THE RESPIRATORY HEALTH STATUS AND ASSOCIATED FACTORS OF HOME-BASED POWER LOOM WORKERS IN RURAL VILLAGES OF SALEM DISTRICT, TAMILNADU

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ABSTRACT Textile-sector is the second highest employer in India with Tamilnadu alone employing 10,18,961 workers [PEDXCIL]. Globally, Incidence of dust related disease among textile workers is nearly 40%. But most studies focus on workers in Power-loom Industries, and not on workers in home-based power-loom. Hence the aim was to assess the respiratory health status of home-based power-loom workers and their association with working environment quality. This cross-sectional study was conducted from August to September 2021 among adults engaged in home-based power-loom in Tamil Nadu using an interviewer administered semi structured questionnaire and the data was analyzed using SPSS-16. More than half (67.1%) had poor respiratory health with significant ($p<0.05$) association with factors such as age, Education, Income/month, Cross-ventilation, number of power-looms operational/room and years of exposure. Hence, respiratory protection programme and dust-reduction measures should be reinforced by raising knowledge about the need of cross-ventilation and regular monitoring of indoor-air quality.

KEYWORDS : Power-loom, Occupational exposure, Respiratory symptoms, Dust.

INTRODUCTION

India, being a developing country with majority of its population living in rural areas, are dependent on small-scale industries for survival. Textile sector is the second highest employer in India. [NITI AAYOG,2014]. In the Indian textile and clothing industry, the power loom sector plays an important role. Power loom sector is the mechanized or modernized form of handloom. The power loom industry is equipped with approximately 2.701 million registered looms, which are concentrated in clusters across Erode, Salem, Madurai, Ichalkarnaji, Solapur, Bhiwandi, Bhilwara and Malegaon, among others. [PEDXCIL Annual report 2019-20] In Tamilnadu alone 10,18,961 workers are employed in power loom sector [PEDXCIL Annual report 2019-20]. The power loom workers are at a high risk of exposure to dust, generated from the textile manufacturing process. The Global incidence of dust related disease among textile workers is nearly 40%. Studies done in India and elsewhere provide evidence that Textile Industry workers in general and power loom workers are at increased risk of respiratory problems (52%). [Kolgiri, Somnath & Hiremath et.al,2017]. But most studies focus on workers in Power loom Industries, there is a huge gap in research with respect to workers in home-based power loom as the hazards are exposed to the entire family.

OBJECTIVES

1. To assess the respiratory health status of home-based power loom workers.
2. To identify the determinants of respiratory health status of home-based power loom workers.
3. To find the association between working environment quality and Health of the study population.

METHODOLOGY

After Institutional ethical committee approval, a community-based Cross-sectional was done in Salem District for a period of 2 months in which data was collected over a period of one week among adults engaged in home-based power loom for a minimum period of one year. The only exclusion criteria were adults engaged in sectors other than home-based power loom and those not willing for the study. The sample size was calculated based on previous prevalence of respiratory problems in power loom workers of 52 % [Kolgiri, Somnath & Hiremath et.al,2017] with a 95% confidence and relative precision of 20%, and 20% excess sampling to account for non- response, sample size of 140 samples was derived**.** Selection of study participants was done by simple random sampling. Out Of three clusters [Tirupur, Coimbatore and Salem] of home-based power loom workers in Tamilnadu, Salem was chosen. Out of 16 blocks in Salem district engaged in power loom sectors, Tharamangalam was [Statistics Handbook, Salem District,2011]. The number of families engaged in home-based power loom was obtained from Office of the Deputy Director of Handlooms and Textiles, Salem and family register in PHC. The data was collected throughout the daytime to include as many workers as possible, also maximum data on air-quality were collected when the power-looms had operated a minimum of 4 hours and it was ensured that the power-looms were running when the data was collected. If any study subject did not not meet the inclusion criteria the person was skipped, and the next name was chosen. After getting informed written consent, the data was collected using interviewer administered semi structured questionnaire. It consisted of two main sections on sociodemographic factors and general and respiratory health status. The questionnaire took less than 10 minutes to complete and was prepared in Tamil and English to accommodate a participant's preference. Working Environment quality was assessed using calibrated Portable air quality measurement tool for air pollution.

St. George Respiratory Questionnaire [SGRQ]:

The SGRQ[Jones PW,1992] is a 50-item questionnaire developed to measure health status (quality of life) in patients with diseases of airways obstruction. Scores are calculated for three domains: Symptoms, Activity, and Impacts (Psycho-social) as well as a total score. Psychometric testing has demonstrated its repeatability, reliability and validity. Sensitivity has been demonstrated in clinical trials. The SGRQ correlates significantly with other measures of disease activity such as cough, dyspnea, 6-min walk test and FEV_1 as well as other measures of general health such as the SIP and Sf_{36}.

1. Part 1: Symptom's component (frequency & severity) with a 1, 3 or 12-month recall (best performance with 3- and 12-month recall);
2. Part 2: Activities that cause or are limited by breathlessness.
3. Part 3: Impact components (social functioning, psychological disturbances resulting from airways disease) refer to current state as the recall.

Scores range from 0 to 100, with higher scores indicating more limitations.

Portable calibrated Air quality monitor:

Air quality was measured by using calibrated Portable Air Quality Monitor calibrated by Bio-medical engineer of Madras Medical College. [Temtop M2000 2nd Generation Air Quality Monitor for PM2.5, PM10, CO2 & HCHO-Air Quality Monitor device with high precise electrochemical formaldehyde sensor, laser particle sensor, and carbon dioxide sensor based on NDIR with CE, FCC Certification] The monitor measures Particulate Matter 2.5 microns or smaller in size ($PM_{2.5}$), Particulate Matter 10 microns or smaller in size (PM_{10}). Indoor values were taken at the middle of the room where power-looms were operational and at mid-day to ensure that the power-looms were operational for at least 4 hours at the time of measurement. Outdoor

Values were taken 100m from the entrance to the home. Measurements were classified as FRESH [Level 1&2] or UNQUALIFIED based on level of health concern [Wambebe, Nathaniel et.al...,2020] as shown in Table 1. We analyzed the data using the Statistical Package for Social Sciences (SPSS) software, version 21. The results are presented as means and standard deviations for normally distributed data, or as percentages for categorical data. Categorical variables were compared using Chi-square test. For all the analysis, p value of ≤ 0.05 was assumed to be statistically significant.

Table 1: Aqi Index And Level Of Concern [wambebe, Nathaniel Et.al...,2020]

AQI Value Of Index	Levels of Health Concern	$PM_{2.5}$ Conc. (µg/m³)	PM_{10} Conc. (µg/m³)	Daily AQI Color	Air Pollution Level
0–50	Good	0–12	0–54	green	Level 1
51–100	Moderate	12.1–35.4	55–154	yellow	Level 2
101–150	Unhealthy for sensitive groups	35.5–55.4	155–254	orange	Level 3
151–200	unhealthy	55.5–150.4	255–354	Red	Level 4
201–300	Very unhealthy	150.5–250.4	355–424	Purple	Level 5
301 and Higher	Hazardous	250.5–Higher	425–Higher	Maroon	Level 6

RESULTS

A total of 140 males participated in the study. The mean and Standard deviation of various demographic and other study variables are shown in Table 2. Mean age of the study participants was 44.7±16. 75.4% of study participants had co-morbidities and 32.5% were smokers. The mean number of power-looms operational in each house was 3.99±1.45, Power-looms were operated 6 days in a week for a minimum of 8 hours per day and the average years of working was 12.9±8.33. Outdoor PM values were measured at 100 meters from the entrance of the home. Average $PM_{2.5}$ and PM_{10} values were 32.47±1 and 39.54±1.46. These values correspond to a Health Level concern of Good to Moderate indicating Fresh air quality. Indoor Values of $PM_{2.5}$ and PM_{10} were 56.87±15.91 and 149.1±20.12. These values indicate a higher level of air contamination when the machines are operating. It was observed that most people engaged in home-based power-loom sector were < 50 years of age (65%) and their income was less than Rs.20000/month (77.1%). Most of them were married (92.1%) and most of them were in nuclear family (74.3%). It was observed that the presence of cross-ventilation in rooms where power-looms were operating was only 30.7%. The Respiratory health status of the participants were measured using the St. George Respiratory Questionnaire [1 year Recall]. Mean Total Score was 46.66±14.22 whereas the Total Score in general population studies are shown to be 12.2. For the Respiratory health status of Power-loom workers, a Total score of 18.22 (<2SD) was identified as cut-off and those below 18.22 were considered to have good health status and those above the score were considered to have poor health status. It was observed that overall, among the study participants 67.1% of them [N=94] had poor respiratory health status. Regarding the symptoms reported, Cough [62%] was the most common followed by breathlessness [31%]. Table 3 shows the association between Respiratory health status and socio-demographic and air-quality variables. Statistical analysis using chi-square test with significance set at p<0.05 was performed for the study variables. Age being more than 50 years had statistically significant odds [P=0.007, AOR-3.04, 95%CI: 1.32-7.02]. similarly, those with education up to Primary level [P=0.049, AOR-2.23, 95%CI: 0.98-5.04] and those earning less than Rs.20000 per month [P=0.018, AOR-3.30, 95%CI: 1.17-9.25] and were living as Joint Family [P=0.016, AOR-3.12, 95%CI: 1.19-8.17] had statistically significant odds for poor respiratory status. Regarding the environmental and occupational factors, lack of cross-ventilation [P=0.002, AOR-4.32, 95%CI: 1.66-11.21], the number of power-looms operating per room more than 3 [P=0.032, AOR-2.24, 95%CI: 1.06-4.72] and the years of exposure more than 10 years [P=0.000, AOR-5.12, 95%CI: 2.39-10.98], and the indoor-air quality [P=0.001, AOR-3.66, 95%CI: 1.68-7.94] had statistically significant odds for poor respiratory status.

Table 2: Mean And Standard Deviations Of Demography, Air-quality And Respiratory Symptoms. [*sgrq- St. George Respiratory Questionnaire]

Sr.NO	DESCRIPTIVE STATISTICS	MEAN	SD	RANGE
1	AGE	44.7	16	20-82
2	MEMBERS IN FAMILY	4	1.1	3-8
3	NO. OF POWER LOOMS OPERATIONAL	3.99	1.45	1-12
4	YEARS OF EXPOSURE	12.9	8.33	2-35
5	OUTDOOR PM2.5	32.47	1	30.81-35.58
6	OUTDOOR PM10	39.54	1.46	34.23-44.67
7	INDOOR PM2.5	56.87	15.91	34.45-80.67
8	INDOOR PM10	149.1	20.12	96.87-206.8
9	SGRQ* SYMPTOM SCORE	64.38	15.73	17.7-95.84
10	SGRQ ACTIVITY SCORE	41.8	10.18	11.21-62.67
11	SGRQ IMPACT SCORE	41.54	16.17	0-73.88
12	SGRQ TOTAL SCORE	46.66	14.22	12.31-75.1

Table 3: Association Between Respiratory Status And Demography And Air-quality

Sr. NO	VARIABLES		SGRQ STATUS		p-VALUE	OR	LOWER CI	UPPER CI
			GOOD	POOR				
1	AGE	<50	37	54	**0.007**	3.04	1.32	7.02
		>50	9	40				
2	EDUCATION	HIGH SCHOOL	36	58	**0.049**	2.23	0.98	5.04
		PRIMARY	10	36				
4	INCOME	<20,000	41	67	**0.018**	3.30	1.17	9.25
		>20,000	5	27				
5	FAMILY TYPE	NUCLEAR	40	64	**0.016**	3.12	1.19	8.17
		JOINT	6	30				
6	CROSS-VENTILATION	PRESENT	40	57	**0.002**	4.32	1.66	11.21
		ABSENT	6	37				
7	NUMBER OF POWER LOOMS	< 3	20	24	**0.032**	2.24	1.06	4.72
		> 3	26	70				
8	YEARS OF EXPOSURE	< 10	31	27	**0.000**	5.12	2.39	10.98
		> 10	15	67				
9	INDOOR-AIR QUALITY	FRESH	34	41	**0.001**	3.66	1.68	7.94
		UNQUALIFIED	12	53				

DISCUSSION

The findings of the study are compared to those of studies conducted among the general population and other industrial workers in other countries, as there are few studies on the respiratory health condition of home-based power loom workers. In general, the higher age has been established as a risk factor for respiratory morbidities. A study by A.K. Mishra et al (2004) on cotton textile workers with age over 40 years was more likely to suffer from respiratory morbidities. This was quite like the findings of our study wherein significant association was seen between chronic respiratory morbidities and age group >50 years (OR–3.04). Another study [Ajeet et.al 2010] among Spinning Mill Workers in India found significant association with duration of exposure of >20 years (OR-2.79). In our study also significant association was seen between Years of Exposure>10 years and Respiratory health status. [OR-5.12 95%CI 2.39,10.98]. Previous study done on "Lung function in Lancashire cotton and manmade fiber spinning mill operatives" [David Fishwick,1996.] explained that Respiratory functions is decreased when there is increase in years of exposure. It is probably because of the hypertrophy of mucosal cells due to irritation by dust that results in increased secretions of mucus and formation of mucosal plugs and causing the obstruction to the exhaled air [Rajkumar, Pattabi, Vadivoo.et.al.2017]. In a study done among workers in various industries in Baltimore, Maryland [Sarah et.al,2020], exposure to organic and biological dusts led to increases in SGRQ (β:3.5;95% CI:1.4, 5.7; p<0.01). In our study too air-quality was found to be significant for SGRQ. [AOR=3.66, 95% CI: 1.68,7.94]. The best possible respiratory health status was reported by only 32.86% of workers i.e 67.1% [59.2 to 75.0] of study participants were suffering from poor respiratory health as assessed by SGRQ. This is in accordance with a study done in EL-Mahalla, Egypt [Mohamed Awad Tageldin,2017] in Mill workers where the prevalence of respiratory symptoms varied among various sections of the company, with the highest respiratory symptoms among spinning workers (76.0%) and weaving workers (60.0%). In another study done in cotton mills in Ethiopia [Daba,Wami S, Chercos DH et al,2018], workers in inadequately ventilated working units had 2.4 times higher odds of developing respiratory symptoms compared to their counter parts (AOR = 2.4, 95% CI: 1.17, 4.91). In our study too, the absence of cross-ventilation was found to be significantly associated with poor respiratory health. [AOR=4.32, 95% CI:1.66,11.21]. In addition, education, income, and type of family and the Number of power-looms

operational too had significance with respiratory symptoms.

CONCLUSION

The results of this study show that there are substantial links between various factors and the respiratory health of home-based power-loom workers. With respect to Socio-demographic factors age, education, income, and type of family had significance with respiratory symptoms. With respect to environmental and Occupation related factors lack cross-ventilation, the number of power-looms operating per room and the years of exposure, and the indoor-air quality had significant associations with development of respiratory symptoms. Home-based power-loom workers' respiratory protection programme and dust-reduction measures should be reinforced by raising knowledge about the need of cross-ventilation, PPE and regular monitoring of indoor-air quality using PM2.5 and PM10 measurements.Adequate awareness and screening campaigns, as well as timely diagnosis and referrals to treatment services in "home-based" power loom workers must be implemented.

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