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Community Medicine

PREVALENCE OF RESPIRATORY ILLNESS AND ASSOCIATED FACTORS AMONG FISHING TRAWLER WORKERS IN TAMIL NADU.

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ABSTRACT In India, an estimated half a billion people work in fishing-related jobs. Trawler fishermen are frequently exposed to long hours of fuel exhaust, but little is known about the adverse effects of this exposure. The aim of this study is to assess the prevalence of respiratory illness among Fishing Trawler workers and its association between the working environment quality. This cross-sectional study was conducted from April 2021 to June 2021 among adults engaged in trawler fishing in Tamil Nadu using an interviewer administered semi structured questionnaire and the data was analysed using SPSS version 16. The prevalence of respiratory symptoms was 81% and respiratory illness was 36.5% with significance between years of working(p=<0.05), days a month worked(p=<0.05), hours of exposure(p=<0.05), history of smoking(p=<0.05) and air quality(p=0.05). Trawler fishermen's respiratory health may be compromised by fuel exhaust and exposure duration. More attention and surveillance of trawler fishermen's occupational health is required.

KEYWORDS : Trawler Fishing, Occupational exposure, Respiratory symptoms, Trawler fuel.

INTRODUCTION:

Fisheries is a significant industry in India. It creates opportunity for millions of people and adds to the country's food security. During the fiscal year 2017-18, the country exported 13,77,244 tonnes of fish and fish products valued Rs 45106.89 crore (US$ 7.08 billion) (Fisheries GIM 2019). However, many fishermen in India engage in the informal economy and often operate in dangerous conditions with little to no occupational safety.

In India, there are two main types of marine fishing vessels. Sub-mechanized power-driven wooden or fibre boats used in the sea for fishing from a few days to weeks, called Trawlers, and hand-driven man-powered tiny vessels, or Catamarans, used for a single day fishing. Typically, marine fisherman sail in the deep sea without suitable safety and/or sanitation, as well as the necessary boat equipment. For trawler fisherman, indoor air pollution and noise emissions are also an occupational health concern (Shiryaeva O et al., 2011). Due to economical constraints, most fisherman utilise non-refined diesel for diesel-powered engines. This adulterated diesel, on the other hand, comprises a mixture of toxic compounds such as naphtha, kerosene, and volatile hydrocarbons, which produce harmful air pollutants for respiratory health to exposed fisherman (Di Yage et al., 2009). Recent research shows that low-cost fossil fuel combustion and poor engine quality contribute to a wide range of respiratory disorders, including asthma, chronic obstructive pulmonary disease (COPD), and even lung cancer (Isakson et al., 2001; Ugelvig Petersen K et al., 2020). Previous research into the health of fishermen's lungs has yielded mixed results in terms of health effects and quality of life (Matheson C et al., 2001).

Smaller particulate matter can remain airborne, scatter widely in the environment, and penetrate deep into the lungs when breathed to distribute throughout the respiratory system due to their size and low density. There is currently no safe level of particulate matter exposure. Because of the high number of diesel engines used in trawlers, diesel exhaust particles account for a significant portion of particulate matter (Ghio, A. J, 2012). Exposure to diesel exhaust particles or air pollution markers indicative of diesel exhaust has been linked to respiratory symptoms such as cough, wheeze, and shortness of breath, hospital admissions, and mortality in epidemiologic studies. Increases in overall discomfort scores and greater airway resistance have been found in clinical investigations employing diesel exposure (Robinson, R. K, 2018).

OBJECTIVES:

To assess the prevalence of respiratory illness among Fishing Trawler workers.

To find the association between working environment quality and respiratory illness of the study population.

MATERIALS AND METHODS

A cross-sectional study was conducted to estimate the prevalence of respiratory illness among the fishing trawlers workers in Tamil Nadu between April to June 2021 using an interviewer administered semi structured questionnaire after we took ethical approval from the Institutional Ethics Committee of the Madras Medical College. The sample size was calculated assuming the prevalence of Respiratory illness among the workers in trawler fishing as 86.2 %, based on the study by Moitra S et al., 2015 with a confidence interval of 95%, absolute precision of 5% and applying 10% non-response rate. The final sample size derived was 200.

Inclusion Criteria was all adults working in the fishing trawler for a minimum of 1 year and exclusion criteria was all study participants engaged in sectors other than trawler fishing and those not willing for the study.

A multistage stage random sampling was done, and finally proportionate sampling done to include study participants. Out Of the 6 major fishing harbours in Tamil Nadu, Royapuram fishing harbour, Chennai was chosen by simple random sampling. Among the 6000 and above trawlers registered in Tamil Nadu almost 1500 trawlers are functioning from Royapuram fishing harbour, Chennai (ANIMAL HUSBANDRY, DAIRYING AND FISHERIES DEPARTMENT, POLICY NOTE 2015-2016). Among the registered Fishing Trawlers in Royapuram Fishing Harbour 200 Trawlers were chosen by simple random sampling by random number generator. One worker from each Trawler willing to participate in the study was chosen randomly among the 10 to 20 workers in each Trawlers.

The selected participants were contacted individually and were explained on the significance of the study and the respondents who completed the survey received a note encouraging them and thanking their contribution to the study. The questionnaire was developed in English and was then translated into Tamil. Back translation was done to know the quality of translation through experts. Prior to the administration of the questionnaire, local experts validated the content of the questionnaire, and the questionnaire was pilot tested among the peers and experts from the institute. After final approval the study was conducted among the study participants. Questions were presented bilingually in both English and Tamil language depending on the preference of the study participants. The respondents were informed that their participation was voluntary and informed consent was obtained before initiating the study. The participants were assured that their identity will not be disclosed and concealed.

The questionnaire was designed with four components comprising of comorbidity profile, history on respiratory illness (Mahesh P A et al., 2009), measurements of air quality and the demographic profile of the participants to compare with the former components. The questionnaire illustrates the predictors of the respiratory illness.

Air quality was measured by using calibrated Portable Air Quality Monitor calibrated by Bio-medical engineer of Madras Medical College. 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}), Formaldehyde (HCHO) and Total volatile organic compounds (*TVOC*). Air quality was classified into healthy, unhealthy, and hazardous. (*Environmental Protection Agency, 2021*).

$PM_{2.5}$ concentration measurements less than 12g/m^3 was considered healthy, measurements between 12.1 to 55.4g/m^3 was considered unhealthy and measurements above 55.5g/m^3 was considered hazardous.

PM_{10} concentration measurements less than 54g/m^3 was considered healthy, measurements between 55 to 254g/m^3 was considered unhealthy and measurements above 255g/m^3 was considered hazardous.

HCHO [Formaldehyde] concentration less than 0.100mg/m^3 was considered healthy, measurements between 0.101 to 0.500mg/m^3 was considered unhealthy and measurements above 0.501mg/m^3 was considered hazardous.

TVOC [Total Volatile Organic Compounds] concentration less than 0.500mg/m^3 was considered healthy, measurements between 501 to 1.500mg/m^3 was considered unhealthy and measurements above 1.500mg/m^3 was considered hazardous. (Anon n.d. 2021). We analysed 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.

RESULTS:

As shown in Table 1, the average age of the respondents was 39.32 years, with a SD of 7.33 ranging from 26 to 45 years. The highest proportion of respondents were between the age group of 34 to 42 years (79.7%). All the respondents were men proving it to be a male predominant field of work, while most of the respondents (75.2%) were Hindus. More than three quarters of the respondents (77%) were married, while only 14.5% of the respondents had some form of basic schooling knowing to read and. About two-thirds of the respondents (70%) were living a nuclear family. 51.5% of the study population had no co-morbidity and are not on medication of any form. The mean household income was Rs. 40590 with a SD of Rs. 8111 ranging from Rs. 25000 to Rs. 60000.

Nearly half of the participants (55%) were smokers with a mean number of cigarettes smoked per day 6 with a SD of 3.48 ranging from 0 to 10 cigarettes. Considering the air quality, the mean $PM_{2.5}$ measurement was 66.15g/m^3 with a SD of 18.09g/m^3 ranging from 45g/m^3 to 104g/m^3. The mean PM_{10} measurement was 96.6g/m^3 with a SD of 29.19g/m^3 ranging from 62g/m^3 to 152g/m^3. The mean HCHO measurement was 0.14mg/m^3 with a SD of 0.06mg/m^3 ranging from 0.1mg/m^3 to 0.2mg/m^3. The mean TVOC measurement was 1.31mg/m^3 with a SD of 0.37mg/m^3 ranging from 0.9mg/m^3 to 2mg/m^3.

Table 1: Mean, Standard Deviations And Range Of Demograpgy Profile And Measured Air Pollution.

DESCRIPTIVE STATISTICS				
Sr. No	**VARIABLES**	**MEAN**	**SD**	**RANGE**
1	AGE	39.32	7.33	26 - 45
2	INCOME	40590	8111.77	25000 - 60000
3	YEARS OF SMOKING	13.83	8.33	0 -25
4	NO OF CIGARTES PER DAY	6	3.48	0 - 10
5	NO OF YEARS TRAWLER	12.66	6.38	4 - 30
6	HOURS OF EXPOSURE PER WEEK	79.19	10.91	48 - 100
7	NO OF DAYS TRAWLER	16.74	2.46	12 - 20
8	$PM_{2.5}$	66.15	18.09	45 - 104
9	PM_{10}	96.6	29.19	62 - 152
10	HCHO	0.14	0.06	0.1 - 0.2
11	TVOC	1.31	0.37	0.9 – 2

Table 2: Respiratory And Comorbidity Profile Of Trawler Fishermen

RESPIRATORY AND COMORBIDITY PROFILE				
Sr. No	**VARIABLES**		**FREQUENCY**	**PERCENTAGE**
1	CO-MORBIDITY	DIABETES MELLITUS	46	23
		HYPERTENSION	27	13.5
		VISUAL IMPAIRMENT	17	8.5
		HARD OF HEARING	69	34.5
		OTHERS	67	33.5
2	RESPIRATORY SYMPTOMS	PROLONGED COUGH	61	30.5
		CHRONIC PHLEGM	28	14
		MORNING COUGH AND SPUTUM	57	28.5
		WHEEZING	39	19.5
		BREATHING TROUBLE	64	32
		NASAL ALLERGY	101	50.5
		BLOCKED NOSE	53	26.5

More than a third of the participants (36.5%) reported that they had difficulty in breathing and were on treatment for the same. As shown in Table 2, when enquired on the respiratory symptoms 30.5% of the participants reported as having prolonged cough, 14% had problems with chronic phlegm, 28.5% reported to have morning cough and sputum, 19.5% reported to have wheezing issues, 32% had some form of breathing trouble, 26.5 reported to have frequent blocked nose and majority 50.5% reported to have some form of nasal allergy as respiratory problem. The overall prevalence of respiratory illness was 81%.

When discussed on the comorbidity profile among the trawler fishermen other than respiratory illness 23% of them were diagnosed with Diabetes and were on treatment for it and 13.5% of the participants were on treatment for hypertension. When enquired on visual impairment 8.5% of them had some form of visual problems for which they were not on any treatment and 34.5% had hard of hearing for a while. One third of the study participants 33.5% have other type of comorbidity like dermatitis, varicose vein, arthritis, and dental carries. Majority of the participants never visited a health facility to get screened for any medical ailment.

Among fishing trawler workers, the average years of working in trawlers was 12.66±6.38 [4 to 30 years]. Average hours of stay or exposure in the trawlers per week was 79.19±10.91 [48 to 100 hours per week]. Considering the number of days working in the trawlers the mean was 16.74±2.46 [12 to 20 days a month] working in the trawlers as explained in Table 1.

Table 3: Association Between Respiratory Health And Demographic Profile With Air Quality.

DETERMINANTS AND ITS ASSOCIATION (CHI SQUARE)					
Sr. No	**VARIABLES**		**RESPIRATORY SYMPTOMS**		**P VALUE**
			YES	**NO**	
1	AGE IN YEARS	>39	36	53	0.35
		<39	37	74	
2	EDUCATION	FORMAL SCHOOLING	18	11	**0.02**
		HIGH SCHOOL	55	116	
3	INCOME PER MONTH	>40000	46	34	**0.00**
		<40000	27	93	
4	MARITAL STATUS	MARRIED	67	88	**0.00**
		SINGLE	6	39	
5	H/O SMOKING	SMOKER	68	42	**0.00**
		NON-SMOKER	5	85	

6	NO OF YEARS IN TRAWLER	<13	24	93	**0.00**
		>13	49	34	
7	NO OF DAYS IN TRAWLER PER MONTH	<17	21	97	**0.00**
		>17	52	30	
8	NO OF HOURS OF EXPOSURE	<79	61	71	**0.00**
		>79	12	56	
9	AIR QUALITY	UNHEALTHY	12	98	**0.00**
		HAZARDOUS	61	29	

More than half 55% of the trawlers had unhealthy levels of indoor air pollution and 45% of the trawlers had levels higher considered to be hazardous to the trawler fishermen. None of the trawlers had permissible levels of particulate matters of volatile compounds or carbon particles. From Table 3 we can clearly understand that 10.9% of the study subjects had respiratory symptoms among unhealthy air quality trawlers when compared to hazardous air quality trawlers with 67.7% presenting with respiratory symptoms.

For better analysis of association between respiratory illness and its associated factors among the participants, those who presented with persistent symptoms of more than six months were considered yes for respiratory symptoms with n = 73. On analysing the categorical variables as associated factors there was significant association with various demographic profile and the respiratory health as shown in Table 3 with p value <0.05. There was no significant association with age and nature of job in trawlers. Significant association was found with income, marital-status, smoking, working in years, days per month and hours per week. Significance was found with the air quality and the respiratory health which is shown in Table 3.

DISCUSSION:

In a study by Moitra S et al., (2015) the prevalence of respiratory illness was found to be 86.2% which is close to the findings of this study with 81%. Income of the participants had a significant association with the respiratory symptoms as with increased income the study subjects were working longer hours and getting exposed for longer hours. In our study marital status and education had significant association with respiratory symptoms among trawler fishermen. The prevalence of smokers among the study participants was 55% in our study which is higher than the study by author Moitra S et al., (2015) among Trawler fisherman in India with 28.9%. The prevalence of chronic respiratory illness among smoking trawler fishermen was 61.81% which is higher than the smokers in general population as 16.8% (Toren K, 2020).

Duration of working in the trawlers more than 13 years had significant association with respiratory symptoms among the study participants due to the prolonged working duration in the trawlers. Similarly, those study participants working more than 17 days in a month had significant association with respiratory symptoms among the study participants.

Similarly, those study participants working for 79 hours per week were significantly associated with the respiratory symptoms which were probably due to the prolonged working duration in the trawlers and the prolonged exposure to the combustion fuel exhausts which is similar to the findings in the study by Moitra S et al., (2015) as 66 hours. The higher levels of $PM_{2.5}$, PM_{10}, HCHO and TVOC were found to be associated with the respiratory symptoms in this study which is identical to the findings observed in the systematic review by Weitekamp CA, et al., (2020).

CONCLUSION:

We find that fishermen exposed to trawler fuel exhaust had differing respiratory symptoms. The exposed fisherman was more likely to develop respiratory symptoms such as chronic phlegm, a persistent cough, and difficulty breathing, as well as allergic symptoms such as nasal block and runny nose among 81% of study subjects which is higher than the general population and chronic respiratory symptoms lasting for more than six months was observed among 36.5% of study participants. These findings shed light on the substantial likelihood of unregulated workplace exposure and respiratory disease, particularly among employees in the informal sector. Almost to half of the study participants 50.5% presented with inflammatory response presenting as rhinitis and nasal obstruction. Longer duration of exposure towards trawler fuel exhaust and combustion particles were significantly associated with the respiratory symptoms. Smoking among trawler fisherman was an augmenting factor in aggravating the symptoms.

An effective strategy should employ a variety of options, from improvements in the quality of engine used and servicing the engines frequently. Guidelines to ensure adequate cross ventilation in engine rooms or provision of separate room for engine, Lead and adulterant free fuel at a subsidised cost by the concerned authorities to reduce the hazardous combustion particles. Quality check cleared personal protection equipment's in subsidised cost to the trawler fishermen which could reduce the burden of indoor pollution and increase the quality of life. Similarly, Health education to increase awareness and frequent medical screening camps with specialist to identify the adults with respiratory symptoms and early treatment initiation could reduce chronic symptoms and ailments to reduce the burden of indoor pollution and increase the quality of life.

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