International Journal of Physiotherapy and Research,
Int J Physiother Res 2015, Vol 3(2):986-91. ISSN 2321-1822
DOI: http://dx.doi.org/10.16965/ijpr.2015.120

Original Article

A STUDY TO EVALUATE RESPIRATORY SYMPTOMS AND LUNG FUNCTION IMPAIRMENT IN BEEDI WORKERS AND USEFULLNESS OF PROTECTIVE MASK IN REDUCING RESPIRATORY SYMPTOMS

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ABSTRACT

Background and Purpose: Problems of the occupational health management are posing serious challenges before the mankind globally. Occupational disease if unaddressed leads to deviation from health. The aim of the study is to study the prevalence of respiratory symptoms and lung function abnormalities and to find out the usefulness of protective mask in reducing respiratory symptoms in tobacco workers.
Materials and Methods: Quasi experimental study includes those workers exposed to tobacco dust in beedi industry recruited with minimum of three years of experience and age group of 20 to 40 years. Control group includes age and sex matched subjects who are not exposed to tobacco dust.
Results: There were significant difference exist between experimental and control group in the prevalence of respiratory symptoms. How ever there was no significant difference between FEV1 and $FEF_{(25-75)}$ between two groups.
Conclusion: Prevalence of respiratory symptoms was found to be in beedi workers and the ventilatory capacity data were similar in both the groups.
KEY WORDS: Respiratory function, Spirometer, Tobacco dust, Lung function.

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Access this Article online

Quick Response code

DOI: 10.16965/ijpr.2015.120

International Journal of Physiotherapy and Research
ISSN 2321- 1822
www.ijmhr.org/ijpr.html

Received: 12-03-2015	Accepted : 23-03-2015
Peer Review: 12-03-2015	Published (O): 11-04-2015
Revised: None	Published (P): 11-04-2015

INTRODUCTION

The World Health Organization, (WHO) estimates occupational health risks as the tenth leading cause of morbidity and mortality. Respiratory disorders among tobacco workers have been described by several authors, because of the nature of the manufacturing operations in the tobacco industry, certain potential health hazards exists for tobacco workers. The health effects of working with tobacco are many. The tobacco is one of the important cash crops in the country and makes a significant contributor to occupational illness [1]. Beedis (or “beedies”) are small, flavored, filter less Indian cigarettes. They consist of shredded tobacco rolled in dried tendu leaves (a broad-leafed plant native to India) and secured with string. Tobacco dust causes an allergic response that occurs either in the upper airways or in the bronchi, or in both [2].

In evaluating overall lung respiratory health, spirometry is a useful test that measures the volume of air expelled from fully inflated lungs over time. Many indexes, both inspiratory and expiratory, may be derived from the spirometric

tracing; it is the indexes of forced expiration that are most commonly used to assess lung functions. FEV_1 is diminished in obstructive lung diseases. Peak expiratory flow rate (PEFR) is the maximum flow rate during a maximum expiration and it is a useful test in determining the severity of the airway obstruction and in follow up [3,4].

The short-term as well as the long-term effects of pollution superimposed on the effects of cigarette smoking are of clinical importance to physical therapists for several reasons. First, physical therapists may be required to manage the acute symptoms as well as the long-term effects of pollution. Second, they may be required to treat patients who are experiencing acute or long-term effects of pollution as secondary conditions. Third, pollution exposure as well as smoking is an important consideration in the management of the peri operative or mechanically ventilated patient. Fourth, physical therapists need to be increasingly involved in public health campaigns and in the formulation of policy related to pollution control.

However, in the literature, there have been a limited number of reports on effectiveness simple protective masks in tobacco workers, but there are no published studies of protective equipment applied on tobacco industry workers. In India, over 3 million workers employed in the beedi industry receive massive, chronic exposure to unburnt tobacco. While the hazards of habitual tobacco usage are well established very little information is available about the effects of occupational tobacco exposure.

In the present study, tobacco industry workers (TIW) were given questionnaire and underwent spirometric evaluation and intervention of five months for the usage of simple protective mask. Most of the studies on tobacco workers says that they exhibit hypersensitivity due to allergic alveliolitis and asthmatic reaction. The result of a study of the respiratory symptoms to tobacco dust exposure shows comparatively low prevalence of chronic respiratory symptoms. There are evidences that conclude that potential health hazards for the workers in tobacco industry [5,6].

The recent evidences suggests that long term exposure to particulate matter has serious effects on health [7,8] and short term exposure has few illness [9,10]. Hence it is found that there is dearth of evidences about the usage of the protective measure in such short term exposure studies. However, in the literature there have been a limited number of reports on effectiveness simple protective masks in tobacco workers, but there are no published studies of protective equipment applied on tobacco industry workers. So, our study is to evaluate the respiratory function in the workers exposed to tobacco dust and the effectiveness of protective mask in tobacco processing plant.

METERIALS AND METHODS

The study was approved by the institutional ethical committee; 64 healthy subjects were recruited by using convenience sampling. In our study included cooperative healthy male and female subjects of 20 to 40 years of age with minimum 3 years of exposure to tobacco dust. Chest or abdomen pain of any cause, oral or facial pain of any cause, recent myocardial infarction, stress incontinence, dementia or confusional state, pre existing COPD and smokers were excluded from the study. The subjects were explained the procedure and informed consent was taken. Chronic respiratory symptoms were recorded using the St George Respiratory questionnaire. It is particularly helpful to observe the subject with occasional glances to check for distress, and to observe the tracing or computer display during the test to help ensure maximal effort. Initially the subject in short sitting position with nose clip and mouth piece of spirometer placed in mouth, then subject is asked to take 2 to 4 normal breaths followed by active exhalation. Active exhalation is followed immediately by forced inspiration and sudden maximum expiration and asked to continue exhalation as long as possible. At last subject is asked to take a deep inspiration and told to relax by taking the mouth piece out, two to three readings are taken and the spirometer selects the best of readings. For experimental group 32 workers who are exposed to tobacco dust are selected using purposive sampling technique. For control group 32 workers with age

and sex matched subjects who are not exposed to tobacco dust are selected using purposive sampling. Ventilatory capacity measurements were performed by recording the maximum expiratory flow-volume (MEFV) curves on a spirometer (Spirolab; Massimiliano Perillo; Maggiolino, ITALY). The FVC, FEV_1, and the maximum flow rates at 25% of FVC (FEF_{25}) and at the last 75% of the FVC (FEF_{75}) were recorded on the MEFV curves. Measurements were performed in tobacco workers before providing protective mask for five months and again after the five months. Lung function testing was performed according to the recommendation of Quanjer et al [11]. The best values from three technically satisfactory MEFV curves were used as the result of the test. The measured values of ventilatory capacity were compared with the predicted normal values of Quanjer [12].

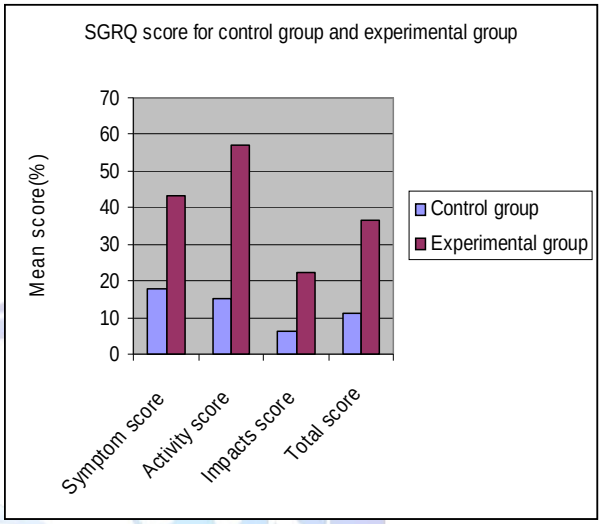
The Valve for the symptoms, Activity, Impact score is referred as St George respiratory questionnaire (SGRQ) score. Scores range from 0 to 100, with higher scores indicating more limitations. The result of this SGRQ scores between the two groups has been compared by Mann-Whitney u test. The results of ventilatory capacity measurements were analyzed by paired and unpaired "*t*" test when comparing baseline values to predicted values and when comparing Pre and Post intervention measurements. The results of ventilatory capacity FVC, FEV_1, $FEF_{(25-75)}$ used as the criteria variables [13,14]. A level of $p < 0.05$ was considered to be statistically significant.

RESULT

64 subjects were selected for the study. There were 30 female tobacco workers included in the study. The experimental and control groups includes 32 in each group. The mean age of women in the study was 37 years (range, 20 to 40 years), and the mean duration of employment was 12 years (range, 1 to 28 years). Only two male workers were studied. Collective data has been analysed by paired "t" and unpaired "t" test and Whitney U test is used to compare the SGRQ Score between the control and experimental group.

Fig 1 presents the prevalences of chronic respiratory symptoms in the 32 tobacco workers, as well as in the 32 unexposed control workers. Significantly higher prevalences for all chronic respiratory symptoms were found in tobacco workers compared to female or male unexposed workers ($p < 0.0001$). The differences were statistically significant ($p < 0.0001$).

Fig. 1: Bar diagram showing SGRQ Score in two groups.



The "p" Valve for the symptoms, Activity, Impact and Total Score was statistically significant ($p<0.001$) and Mann Whitney test valve also found to be positive.
FVC, FEV_1, $FEF_{(25-75)}$ were significantly decreased as compared to control group.

The ventilatory capacities FVC ($p=0.001$) and FEV_1 ($p<0.001$) was significantly lower in experimental group. The comparison of forced expiratory flow between the control and experimental group was also found to be statistically significant before the intervention by providing simple protective mask as shown in table 1.

Table 1: Comparison of FVC, FEV_1 and FEF% between control and experimental groups.

Variable	Group	n	Mean	Std deviation	t & p value
FVC	experimental	31	2.65122	0.7118	0.001
	control	34	2.64766	0.6828	3.438
FEV_1	experimental	31	1.76	0.4564	0
	control	34	2.45	0.626	5.006
FEF%	experimental	31	71.81	19.71	5.939
	control	34	102.97	22.34	0

When we compare the ventilatory capacities after the intervention period of five months there was no significant difference between the FVC,and FEV_1, as shown in table 2.

Table 2: Comparison of FVC and FEV_1 Pre and Post Intervention.

	Mean	Std. Deviation	Paired Differences	t test and P Value
FVC PRE	2.0516	0.7118	0.1413	1.597
FVC POST	1.9103	0.4958		.121 a
FEV1 PRE	1.7652	0.4564	0.0529	1.152
FEV1 POST	1.7123	0.3924		.258 b

There was no significant differences in ventilatory capacities between the pre and post pulmonary function test, even though the positive correlation exist between their parameters as shown below in table 3 and 4.

Table 3: Correlations

Group				FVC PRE	FEV1 PRE	FEF (%)
Control Group	Spearman's rho	Symptoms Score	Correlation Coefficient	-.180	-.103	.082 .646
			p Value	.307	.564	.34
			N	.34	.34	
		Active Score	Correlation Coefficient	.194	.047	-.049
			p Value	.273	.791	.784
			N	.34	.34	.34
		Impacts Score	Correlation Coefficient	.204	.025	-.028
			p Value	.248	.890	.877
			N	.34	.34	.34
		Total Score	Correlation Coefficient	.144	.016	-.028
			p Value	.415	.929	.877
			N	.34	.34	.34

Table 4: Correlations

Group				FVC PRE	FEV1 PRE	FEF (%)
Control Group	Spearman's rho	Symptoms Score	Correlation Coefficient	.124	.041	.335
			Sig. (2-tailed)	.506	.827	.065
			N	.31	.31	.31
		Active Score	Correlation Coefficient	.341	.047	-.035
			Sig. (2-tailed)	.061	.138	.851
			N	.31	.31	.31
		Impacts Score	Correlation Coefficient	.183	.025	-.123
			Sig. (2-tailed)	.324	.483	.510
			N	.31	.31	.31
		Total Score	Correlation Coefficient	.361	.016	-.001
			Sig. (2-tailed)	.046	.124	.994
			N	.31	.31	.31

DISCUSSION

The present study screens the respiratory symptoms in the workers exposed to tobacco dust in tobacco processing plant. Artamonova VG in their study Monitoring upper respiratory tract diseases among workers engaged into contemporary tobacco industry and justifying occupational causes of those diseases occurrence, concluded that tobacco dust could cause upper respiratory tract diseases, therefore these diseases could be occupationally induced [22]. Popovic V, Arandelovic M, Jovanovic J, Veselic E, Popovic A, Momcilovic O, et al conducted a study on "The effect of occupational exposure to respiratory noxae in the tobacco industry on the status of pulmonary ventilation" and the results found point out to the presence of the tobacco dust in these departments and the values exceeding threshold limits might have caused the obstructive changes of airways in the workers exposed [23].

In the present study it has found that most of the workers had an obstructive component evident on the SGRQ and Pulmonary function test. Mengesha YA, in their study Relative chronic effects of different occupational dusts on respiratory indices and health of workers in three Ethiopian factories and it was found that effects of exposure to cotton and cement dusts on respiratory health of exposed subjects were relatively more significant ($p < 0.001$) than that of exposure to tobacco dust [24]. Certain studies shows contradictory result such as Piirila PL studied on " Airway hyper responsiveness, prevalence of chronic respiratory symptoms, and lung function in workers exposed to irritants" and Lower prevalence of symptoms was found for workers exposed to irritents [25].

The present study demonstrates the prevalence of the respiratory symptoms were significantly higher in the exposed workers than that of the unexposed workers. According to Mukhtar MS in his study on "Respiratory effects of occupational exposure to tobacco dust" found that the small airways are affected by exposure to tobacco dust and flow-volume curves are useful in the assessment of lung function status [26].

Various study have found that "Respiratory response to tobacco dust exposure" has negative findings with regard to chronic respiratory effects and significant decreases in ventilatory capacity during the work shift were recorded [20].

Ignacak A did a study on "Influence of tobacco dust on the respiratory system and selected immunological parameters" investigated the relationship between occupational chronic exposition to tobacco dust, respiratory function and some allergic reaction parameters and they have found that FEV_1/VC was significantly lower in tobacco industry workers chronically exposed to tobacco dust than in the control group (91.5 +/- 11.6% vs. 101.7 +/- 10.7% n; $p = 0.0004$). Occupational chronic exposition to the dust of tobacco leaves is associated with significant

increase in the occurrence of mild obstructive ventilatory disturbances [27].

In Contrast to above result there was an article by Osim EE who studied on"Lung function of Zimbabwean farm workers exposed to flue curing and stacking of tobacco leaves" and concluded that restrictive lung defect in the tobacco farm workers and may be attributed to long-term exposure to flue curing and stacking of tobacco leaves [28].

In the present study lung function impairment was found in the tobacco workers as compared to unexposed workers. The ventilatory capacities FVC, FEV_1, $FEF_{(25-75)}$ were significantly decreased in relation to predicted values. The ventilatory capacities FVC ($p=0.001$) and FEV_1 ($p<0.001$) was significantly lower in experimental group. The comparison of forced expiratory flow between the control and experimental group was also found to be significant lower in the experimental group and there was a positive correlation exist between the ventilatory capacities in pre and post pulmonary function test.

Respiratory parameters before and after working in manual laborers at a tobacco factory found hyperspasmatic reaction of bronchi and signs of obstruction. It is also found that obstructive component in the spirometric reading .This finding was similar to the result obtained by Kolarzyk E in which workers who inhaled dust of tobacco leaves prior to fermentation [23].

Hence the protective equipment has been used in the present study by using simple surgical mask to make an attempt to reduce the respiratory symptoms in the workers exposed to tobacco dust and it has been found that the differences was not statistically significant pre and post intervention.

CONCLUSION

The prevalence of the respiratory symptoms is high in the workers exposed to tobacco dust as compared to unexposed subjects. Highly significant difference in the lung function leading to impairment has been found in the experimental group workers.($p<0.001$).Hence the protective mask was not useful in limiting the respiratory symptoms.

ACKNOWLEDGMENT

Authors would like to thank the management of Prakask Beedi workers, Principal and Mentor Dr Ramadevi, Dr M V Shetty college of Physiotherapy and HOD Prof. Dr. Narasimhan, Father Muller's college of Physiotherapy for their complete support to fulfill this study.

Conflicts of interest: None

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How to cite this article:

Mahesh V Hegde, Ajith S, Kavitha Shetty. A STUDY TO EVALUATE RESPIRATORY SYMPTOMS AND LUNG FUNCTION IMPAIRMENT IN BEEDI WORKERS AND USEFULLNESS OF PROTECTIVE MASK IN REDUCING RESPIRATORY SYMPTOMS. Int J Physiother Res 2015;3(2):986-991.
DOI: 10.16965/ijpr.2015.120