

Original Research Article

Association of respiratory morbidity with duration of work among puffed rice workers in Davanagere city, Karnataka, India

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ABSTRACT

Background: Occupational respiratory disease can be defined as an acute or chronic disorder that arises from the inhalation of air-borne agents in the work place. Puffed rice is a famous food item in Karnataka, which is produced in a cluster of small units. Industrial dust inhalation over a long period of time leads to proliferative and fibrotic changes in the lungs.

Methods: A cross sectional study was conducted among puffed rice workers in Bashanagar, urban field practice area of SSIMS and RC, Davanagere. From January 2017 to December 2017. The study population included 550 puffed rice unit workers. Data was collected using structured interview along with anthropometric measurements. Spirometry was done by using RMS (Helio's) Spirometer.

Results: In this study significant association was found between respiratory morbidity and duration of work. The risk of obstructive lung disease was 0.18 (0.03-1.40) times less among workers who worked for <5 years compared to workers who worked for more than 20 years. The risk of restrictive lung disease was 0.35 (CI 0.16-0.77) times lower among workers who worked for <5 years compared to the workers who worked for > 20 years and the association was statistically significant with p value of 0.010.

Conclusions: The risk of respiratory morbidity was significantly associated with increase in the duration of work.

Keywords: Davanagere, Duration of work, Respiratory morbidity

INTRODUCTION

Occupational respiratory disease can be defined as an acute or chronic disorder that arises from the inhalation of air-borne agents in the work place. Subjects with workplace exposure to organic dust have high prevalence of respiratory diseases.¹ Many industrial processes produce air-borne contaminants and the most common

route of absorption is by inhalation.² Puffed rice is a popular food item, which is produced in cluster of small units often located in urban centers. Among various states in India, Karnataka has some of the largest number of clusters of puffed rice units. Major clusters are in townships of Karnataka such as Davanagere, Hubli, Dharwad and Belgaum. Davanagere is the largest supplier of puffed rice not only to other districts of Karnataka but

also to other states. The fuels used in ovens are mainly rice husk, wood shavings, groundnut shell and automobile tyres as they generate high heat and are of low cost. Subjects with work place exposure to organic dust have high risk of prevalence of respiratory diseases. Industrial dust inhalation over a long period of time leads to proliferative and fibrotic changes in the lungs.³ A large number of studies have been undertaken to assess the effect of dust on lung functions in various occupations.⁴ But very few studies have been carried out among the workers engaged in puffed rice production. Due to limited availability of literature on the same, this study was taken up with in order to determine the strength of association between the duration of work and respiratory morbidity among puffed rice workers in urban field practice area of SSIMS and RC, Davanagere.

METHODS

A cross sectional study was conducted during January 2017 to December 2017 among the workers of puffed rice units situated at Bashanagar, Urban field practice area of SSIMS and RC, Davanagere. Ethical clearance was obtained from the Institutional Ethical Review Board. The workers working in these units are aged above 14 years, workers working for greater than 1 year and workers willing to participate were included in the study. Pregnant women, those who have undergone cardiothoracic surgery and recent history of myocardial infarction were excluded from the study. A study by Energy Research Institute among the puffed rice production workers in Davanagere showed that the respiratory morbidity was 15.6%.

Where, 'p' is prevalence of respiratory morbidity 15.6, 'q' is 100-p which is equal to 84.4, 'd' is 20% of p which is equal to 3.12.

$$\text{Hence, } n = \frac{4 \times 15.6 \times 84.4}{3.12 \times 3.12} = 541,$$

n= 541, rounded for 550.

In order to collect data from 550 workers, out of 1200 puffed rice production units situated in Bashanagar, 550 production units were selected by using simple random sampling method using random number table. From each unit only one worker was taken randomly by lottery method. A pretested semi structured and validated questionnaire were used to collect information from each worker after taking informed consent. The questions related to duration of work were taken from American Thoracic society (ATS).⁵ Height measurement in centimetres was done in erect standing position using non stretchable measuring tape and weight was measured in kilogram (kg) using standardized bathroom weighing machine. Spirometry was carried out by the instrument RMS (Helios's) Spirometer. The following parameters were used in the spirometry: 1) forced expiratory volume in the 1st second (FEV1)- it is the volume of air in liters

that can be forcefully and maximally exhaled in the 1st second after a maximal inspiration, 2) forced vital capacity (FVC)- it is the volume of air in liters that can be forcefully and maximally exhaled after a maximal inspiration and 3) FEV1/FVC ratio- it is the amount of air exhaled in the first second divided by all of the air exhaled during a maximal exhalation.

Any person with spirometer reading showing FEV1 <80% of the predicted normal for age and sex, FVC usually reduced but to a lesser extent than FEV1 and FEV1/FVC ratio reduced to <0.7 were considered to have Obstructive pulmonary disease and spirometer showing FEV1 <80% of the predicted normal, FVC <80% of the predicted normal and FEV1/FVC ratio being normal (i.e., >0.7) were diagnosed to have restrictive pulmonary disease. The results of spirometry were assessed according to the criteria followed by American Thoracic Society.⁶ Data was entered in MS EXCEL and statistical analysis was done using SPSS version 20 and results were expressed in terms of percentages and proportions. Analysis was carried out by Chi square test and logistic regression method to find out the association between respiratory morbidity and duration of work.

RESULTS

The prevalence of respiratory morbidity among the puffed rice workers in the present study was found to be 41.0%. Among them 51 (9.2%) puffed rice workers reported obstructive lung diseases and majority of the workers 175 (31.8%) reported restrictive pattern of lung diseases. The patterns of the respiratory morbidity are explained in the Table 1.

Table 1: Distribution of study participants based on pattern of respiratory morbidity.

Variables	Frequency	%
Normal lung function	324	59.0
Obstructive	51	9.2
Restrictive	175	31.8
Total	550	100
Grading of obstruction based on FEV1 ratio		
Mild obstruction (FEV 1>70% pred.)	8	16.0
Moderate (60–69%)	19	38.0
Moderately severe (50-59%)	13	26.0
Severe (35–49%)	11	22.0
Grading of restrictive disease based on FVC ratio		
Mild restriction (FVC>70% pred.)	26	15.0
Moderate restriction (60-69%)	77	44.0
Moderately severe (50-59%)	45	26.0
Severe (30-49%)	23	13.0
Very severe (<35%)	4	2.0

In this study duration of the work of the majority of the workers was 11-20 years and it is significantly associated with respiratory morbidity. Majority of the workers work

for less than 9 hours a day but no significant association was found. The association of respiratory morbidity with duration of work is explained in the Table 2.

Table 2: Association of respiratory morbidity with duration of work.

Variables	Spirometry pattern			Total (%)	χ^2 value	df	P value
	Normal (%)	Obstructive (%)	Restrictive (%)				
Duration of work in years							
<5	47 (45.4)	2 (2.5)	28 (36.36)	77 (100.0)	34.63	6	0.000
5-10	81 (75.7)	3 (2.8)	23 (21.49)	107 (100.0)			
11-20	126 (58)	19 (8.7)	72 (33.1)	217 (100.0)			
>20	70 (46.9)	27 (18.1)	52 (34.8)	149 (100.0)			
Duration in hours/day							
<9	269 (59.8)	46 (10.2)	135 (30.0)	450 (100.0)	5.29	2	0.07
>9	55 (55.0)	5 (5.0)	40 (40.0)	100 (100.0)			
Total	324 (59.0)	51 (9.2)	175 (31.8)	550 (100.0)			

In this study the risk of obstructive lung disease was 0.18 (0.03-1.40) times less among workers who worked for less than 5 years compared to workers who have worked more than 20 years and the association was not statistically significant with p value 0.055. The association of various obstructive lung diseases with duration of work is explained in Table 3.

Table 3: Association of obstructive lung diseases with duration of work.

Variable	OR	95% CI	P value
Duration of work in years			
<5	0.18	0.03-1.04	0.055
5-10	0.24	0.05-1.02	0.053
11-20	0.87	0.37-2.05	0.757
>20	1		

The risk of restrictive lung disease was 0.35 (CI 0.16-0.77) times low among workers work less than 5 years compared to workers who worked greater than 20 years and the association was statistically significant with p value 0.010. Association of duration of work with respiratory morbidity is explained in the Table 4.

Table 4: Association of restrictive lung diseases with duration of work.

Variable	OR	95%CI	P value
Duration of work in years			
<5	0.35	0.16-0.77	0.010
5-10	0.62	0.26-1.43	0.265
11-20	0.89	0.49-1.64	0.728
>20	1		

DISCUSSION

The present study was conducted among workers employed in puffed rice units which are located in Bashanagar, urban field practice area of SSIMS and RC,

Davanagere. In this present study, significant association was found between the respiratory morbidity and duration of work. Similar result was found by study done by Rana et al, Ajeel et al, Prakash et al.^{7,10,13} But in contrast to this a study done by Ratnaprabha et al, Abdulsalam et al showed that no significant association was found between duration of work and respiratory morbidity.^{4,14} In present study the respiratory morbidity was more among the workers who worked less than 9 hours per day but no significant association was found. In contrast, a study done by Rana et al showed that significant association was found between respiratory morbidity and number of working hours per day.⁷ In present study prevalence of respiratory morbidity among puffed rice workers was 41.0%. Among them 51 (9.2%) puffed rice workers reported obstructive lung diseases and majority of the workers 175 (31.8%) reported restrictive pattern of lung diseases. Similar results were found by a case study done by the Energy Research Institute, Bangalore at Davanagere city which showed that majority of the workers possessed restrictive pattern of lung diseases and Tawade et al.^{3,15} In contrast to this study a study done by Rana et al, Ghosh et al showed that majority of the workers in their study were reported to have obstructive pattern of respiratory diseases.^{7,9} In this study the risk of obstructive lung disease was 0.18 (0.03-1.40) times less among workers who worked for less than 5 years compared to workers who work more than 20 years and the association was not statistically significant with p value 0.055. The risk of restrictive lung disease was 0.35 (CI 0.16-0.77) times low among workers worked for less than 5 years compared to workers who worked more than 20 years and the association was statistically significant with p-value was 0.010. Decrease in FVC may be due to changes in the bronchi and elastic component of lungs resulting in restrictive type of lung impairment.¹⁶ Reduction in FEV1 due to exposure to dust causes early obstructive pulmonary impairment which further increases with increase in number of years of exposure.¹⁷

Limitations

The limitations of the present study were that the etiologic diagnosis of respiratory morbidity is not possible by spirometry alone. Chest X-ray and other investigations would have been required for further confirmation. As interview schedule was the primary data collection tool, which required recall of information regarding the exposure, illnesses and personal protective equipment (PPE) usage, the possibility of recall bias exists. Healthy worker bias could be another limitation since those who were severely ill could have died or left the job or shifted to other sections.

CONCLUSION

The prevalence of respiratory morbidity among puffed rice workers in the present study was found to be 41.0%. Among them 51 (9.2%) puffed rice workers reported obstructive pattern of lung disease and majority of the workers 175 (31.8%) reported restrictive pattern of lung diseases. The risk of respiratory morbidity was significantly associated with duration of the work. As the duration of exposure increases the prevalence of the respiratory morbidity also increases.

Recommendations

To initiate provision and promotion of personal protective equipment (such as respiratory mask) to all who were involved in puffed rice units. Cleansing the floor of the puffed rice units only after wetting it, so as to prevent the spread of dust in the air and thereby decreasing the risk of exposure to rice dust several folds. Pre-placement examination of workers be carried out before they join the puffed rice units. Regular periodic medical examination is required. Health education must be done about the dangers of rice dust exposure, occupational lung diseases and other occupational hazards and use of personal protective equipment for protection from hazards.

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