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Effect of Byrates (Barium Sulphate) on Pulmonary Function In Byrates Mine Workers

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Aim Of The Study: *To study the effect of byrate exposure on pulmonary function in byrate mine workers .*
Keywords: *Spirometry, FEV1, FVC, FEV1/FVC, restrictive and obstructive lung diseases.*

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I. Introduction

Occupational Health is defined by the International Labor Organization (ILO) as the promotion and maintenance of the highest degree of physical, mental and social well being of workers in all occupations [1]. According to the WHO report 2002, occupational health risk is one of the leading causes of morbidity and mortality in the world in general and developing countries [2]. Occupational exposure to particulate material causes restrictive lung diseases.

Obstructive pattern	Restrictive pattern
Eg: COPD Bronchial asthma	ILDS Pneumoconiosis etc..
Spirometry changes: Decrease in FEV1 FEV1/FVC ratio	Decrease in FEV1,FVC FEV1/FVC raised or normal

Large epidemiological studies (6, 7, 8, and 9) revealed that a substantial proportion of population, far more than what would be expected as a result of pulmonary impairment has restrictive spirometry results.
Spirometry is a basic tool for respiratory health surveillance which is effort dependent and can be safely performed at low cost. Spirometry results can be classified as Airflow obstruction and restriction is diagnosed with high reliability and validity using the American Thoracic Society and European Respiratory Society (ATS/ERS) recommendations for spirometry (3, 4). Grading of restriction impairment is on basis of the FEV1% of predicted. This may be reasonable since both FVC and FEV1 are reduced as restrictive impairment progresses and the common technical problems of early termination of maneuvers and zero flow errors are less likely to impair the accuracy of FEV1 than the FVC. ERS suggested using FEV1 in categorization of both obstructive and restrictive defects because of simplicity compared to ATS method. The rationale for such proposal in disorders presenting with restrictive defects is because the FEV1/FVC ratio is preserved and hence there may be good correlation between reduction VC and the corresponding reduction in FEV1(5).The categorization as follows

FEV1 (%)	**Categorization**
>70	Mild
>60 - <69	Moderate
>50 - <59	Moderately severe
>35 - <49	severe
<35	Very severe

India is one of the leading producers and exporters of barites in the world. Barytes is used for oil and gas drilling as weighting agent in drilling mud because of its unique physical and chemical properties and magnetic neutrality. It is also used as a feedstock for production of various barium compounds, and is also utilized as filler, extender and aggregate. Another application after its conversion to barium carbonate is in the manufacture of ceramic and glass.

1.1. Exposure limit: for byrates according to OSHA PEL, NIOSH PEL, ACGIH TLV is **10mg/m3** of air fraction and **5mg/m3** of respirable fraction as 8 hours TWA.

1.2 Pulmonary effect: Inhalation of barium sulphate cause physical irritation and benign pneumoconiosis (baritosis).

1.3 Clinical manifestations

1.4 Acute exposure: Redness and itching of eyes, nose and scratchy throat.

1.5 Chronic exposure: Radiological evidence of discrete disseminated solitary nodules which mostly disappears on cessation of exposure.

1.6 Medical monitoring: To place workers effectively and to detect work related health effects medical evaluation should be performed before job placement, periodically during the term of employment, at time of job transfer or termination.

II. Method

This study was conducted in south Andhra Pradesh among 100 byrate mine workers. As per study periodical medical examination was conducted. A detailed medical and occupational history was obtained. Body weigh and height, BMI were measured, general examination and spirometry study was done. The information

Duration of exposure to **Barium sulphate particles**	Males	Females
0 -10 Yrs	7	5
11 – 20 yrs	3	3
21 – 30 yrs	1	0
Total	11	8

btained was recorded in a prescribed form. Spirometry was conducted following standard procedure.

III. Materials

Variables	Number	Percentage%
Females	12	12%
Males	88	88%
Age group		
18 -30	55	55%
31-40	31	31%
41-50	12	12%
51-60	2	2%

3.1Number of smokers and non smokers

Cigarette Smoking	Number
Yes	20
No	80

Chi-square test: 0.8816, DF=2, P value: 0.64, NS

IV. Result

In our study, 100 members of by rates mine workers 81 workers are having normal spirometric study and 19 members are with restrictive pattern of pulmonary function in spirometry.

Fev1 (Mean)	Value
Workers With Normal Spirometry.	2.46l
Workers With Restrictive Pattern Of Pulmonary Function In Spirometry.	1.34l

FEV1/FVC (MEAN)	VALUE
Workers with normal spirometry.	87.57%
Workers with restrictive pattern of pulmonary function in spirometry.	83.33%

Out of 19 members with pulmonary impairment	Number
females	8
males	11
smokers	4
Non smokers	15
Lowest FEV1	0.53L

Highest FEV1	2.16L
Lowest FVC	0.85L
Highest FVC	2.06L

V. Discussion

5.1 severity of disease in relation to sex:

Severity of pulmonary impairment	Males	Females
Mild	0	1
moderate	2	3
Moderately severe	4	3
severe	4	1
Very severe	1	0
Total	11	8

Chi-square test=3.763, DF=4, P value: 0.4, NS

In this study females are less severely affected when compared to males probable due to most of female workers are working in less exposure areas but the 1 female worker with severe restriction is working in high exposure areas.

5.2 Duration Of Byrates Exposure To Severity Of Disease**:**

Duration of exposure to By rates (years)				Total
Severity of pulmonary impairment	(0 – 10)	(10 – 20)	(21 – 30)	-
Mild	1	0	0	1
moderate	3	2	0	5
Moderately severe	3	3	1	7
severe	4	1	0	5
Very severe	0	1	0	1
Total	11	7	1	19

Chi-square = 5.217, DF=8; P-Value: 0.7, NS

Among 11 workers with less than 10 years exposure 3 out of 4 are working in high exposure areas are affected with severe pulmonary impairment. Among workers with more than 10 years exposure (8workers) 6 members are with above the level of moderately severe disease. This indicates severity of disease is correlated with duration of years exposed to by byrates.

5.3 Severity Of Disease Among Smokers

No. of smokers with significant pulmonary impairment (total 4)	Severity of pulmonary Impairment (based on FEV1)
2 smokers	Moderately severe restriction(MS)
1 smoker	Severe restriction(s)
1 smoker	Moderate restriction(M)

All are middle aged smokers age between 38 – 47 years, out of 4 smokers 2 smokers are less than 10 years exposure to by byrates, another 2 smokers with more than 10 years exposure. 2 smokers with who have more than 10 years exposure have moderately severe and severe restriction and other 2 with less than 10 years exposure have moderate and moderately severe restriction. Significant effect of restriction is caused by byrates exposure when compared to smoking.

VI. Conclusions

1. In this study out of 100 workers 19 workers are with significant pulmonary impairment.
2. Severity of disease is correlated with duration of years exposed to byrates.
3. Severity of disease increases on exposure to higher concentration of barium sulphate particulate areas (blasting areas)
4. In this study females are less severely affected when compared to males probably due to most of female workers are working in less exposure areas.
5. Significant effect of restriction is caused by rates exposure when compared to smoking.
6.

VII. Abbrevations

1. FEV1: Forced Expiratory Volume At 1st Second.
2. FVC: Forced Vital Capacity.
3. ILO: International Labor Organization.
4. WHO: World Health Organization.
5. COPD: Chronic Obstructive Pulmonary Disease.
6. ILD: Interstitial Lung Disease.
7. ATS: American Thoracic Society.
8. ERS:European Respiratory Society.
9. VC: Vital Capacity.
10. OSHA PEL: Occupational Safety And Health Administration Permissible Exposure Limit.
11. NIOSH REL: National Institute For Occupational Health Recommended Exposure Limit.
12. ACGIH TLV: Americaln Conference Of Governamental Industrial Hygienists Threshhold Limit Value.
13. TWA:Time Weighted Average.

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