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Research Article

**SPIROMETRIC EVALUATION OF LUNG FUNCTION OF  
COAL WORKERS WORKING AT MACH (BOLAN DISTRICT)**  
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<sup>1</sup> Faculty of Pharmacy and Health Sciences, University of Balochistan, Quetta, Pakistan.<sup>2</sup> Department of Physiology, Bolan Medical collage Quetta, Pakistan.**Abstract:**

To evaluate the coal dust effect on lung function among coal workers and non-coal workers. This was case-control study. The 144 male coal workers and non-coal workers, 20-50 years more than one year of working skill were selected. Study was carried out in the Mach, Bolan district in Balochistan, Pakistan. The Spirometer and self-designed survey form were used. The interview was accompanied and information was documented in the survey form and Spirometry was done for coal workers and non-coal workers separately. The statistical measurements and ( $p < 0.05$ ) were detected for coal workers and non-coal workers via SPSS 22. The mean value of FVC in coal workers was (56.81%) and in non-coal workers was (64.84%). The FEV1 in the coal workers was (62.60%) and in non-coal workers was (73.09%). The PEFr was (71.89%) in coal workers but in non-coal workers was (84.61%). The FEV1/FVC ratio was (112.95%) in coal workers and in non-coal workers the mean value was (113.87%). The FEF25-75% in coal workers was (92.34%) and in non-coal workers was (97.57%). Research was resulted that no significant change initiate among coal workers and non-coal workers. The mean value of PEFr, FVC and FEV1 were clearly decreased in coal workers than non-coal workers which should be noticed and if it decreased to 50% or lesser should be hospitalized in time.

**Keywords:** Lung Function, Coal workers, Spirometry, Mach, Balochistan, Pakistan.**Corresponding Author:****Tanzeel Ahmed,**

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**INTRODUCTION:**

Coal has been most commonly and extensively used mineral for eras but at the similar times respiratory illnesses and disabilities associated to the job-related contact to coal soil has been the maximum frequently documented in both established and developing nations [1, 2]. Coal is still an important energy source and is extracted in several republics as well as Pakistan [1]. Pakistan has become wide coal deposits (184 Billion Tones) in entirety in four provinces, as well as NWFP [1]. Hangu and Cherat are the key region in NWFP (North West Frontier Province), famous for coal mining and the projected held in reserve only in Cherat region is of 2 million tones and kinds of the firewood is bituminous [1]. Coal miners at danger increasing numerous disease associated to their work-related dust contact, dependent upon the kind and dust nature, inhaled particles size, age at first contact, entire length of contact and occupation nature [1, 3, 4].

Concealed coal taking out may consequence in the growth of coal worker's pneumoconiosis (CWP), chronic bronchitis, silicosis, and either one individually or in variable mixtures [5]. Pulmonary function defects in coal mine workers may happen in association by each of these pulmonary situations however as in non-coal mines workers, can be extant in the nonappearance of all of them [5]. As smoking of cigarette may also consequence in defects in pulmonary function chronic bronchitis or together, it is frequently problematic and occasionally difficult to describe the comparative assistances of the coal mine dust inhalation and cigarette smoke to the incidence of useful irregularities in a smoking coal mines workers [5]. Also varied soil pneumoconiosis, coal mining has been exposed to be a danger issue for (COPD) [6-11].

The pneumoconiosis is quiet a main reason of debility universal although reduction occurrence in western nations [12] in addition in Pakistan no exception however the disease load is unidentified [1]. Utah, by its massive concealed coal assets can expect a growing future populace of coal mines workers, ground surveys through the (USPHS) United States Public Health Service have established a inferior occurrence of CWP amongst far western instead of mid-western and eastern soft coal mines workers [13]. The analyses of distant western coal comprised one in Colorado and two in Utah [13]. The minor occurrence of CWP in the West can be due to inferior alveolar admission of dust as of lesser levels of mine dust in western coalmines in the past, but it might too be due at smallest in part, to the fresh demonstration that in contrast to "Pennsylvania" fire

wood, Utah fire wood cracks into bigger particles and has fewer cellular poisonousness [14].

In compare, American occurrence researches from the (NSCWP) "National Study of Coal Workers Pneumoconiosis" have not elaborate immediate gathering of dust contact measurements [3]. As an alternative years of concealed coal mine occupation and work-related info have been used as replacement dealings of dust contacts [15-18]. On behalf of instance, the trend just before higher dust levels as one travels from apparent to transport to haulage to face work was used through Kibelstisand colleagues [15], who established a decrease in FEV between non-smoking face employees paralleled by non-smoking surface employees [18].

This study was conducted by the purpose of assessing the association between inhalation coal dusts, this study takings new info on dust contact and relates it to contact reaction replicas for FVC, FEV<sub>1</sub>, PEFR, FEV/FVC and FEF<sub>25-75</sub>.

**METHODOLOGY:****Design of Study:**

This was case-control study.

**Study Location:**

The research was conducted in the Mach, Bolan district in Balochistan, Pakistan.

**Introduction to District Bolan:**

District Bolan is in the midpoint of province of Balochistan, Pakistan. The Bolan pass 85 km lengthy beginnings from (Kolpur), the maximum place in region by a height of 2,200 metres overhead sea neck and neck. The DHQ (District Head Quarter), Dhadar, District Bolan is located close the series of river of Bolan. The District is covered of plain and mountainous zones. Mach Tehsil is practically mountainous while the residual Tehsils i.e. Sanni, Dhadar, Khattan Blanarai and Bhag, are covered of plain zones. Populace for centuries the chief Bolan tribe was Kurd and the Bolan chief and the Sardar Dinnar Khan Kurd was maximum noticeable Bolan personality. The Bolan districts people in {2005} was predictable to be overhead [45, 0000]. The Muslims found above 99 percent of the inhabitants. There is an insignificant Hindu community in sub-division of Bhag. District is having the coal production. Consequently several cases are stated of coal chances which additional deaths lead as well as disability/injuries also several employees involve in coal workers. A appropriate defensive actions essential to take and deliberated to minimize the belongings of such circumstances.

**Sample Selection Criteria:**

The male coal workers and non-coal workers age group between 20-50 years, more than one year of work experience were selected in this study. One hundred and forty four male participants were equally divided in two groups: coal workers and non-coal workers.

**Instruments used for Data Collection:**

The self-designed survey and Spirometer were used. The prior agreement was taken from the all respondents of coal workers and non-coal workers.

**Study Procedure:**

The total 144 study participants were nominated. The participants were alienated into two groups on the bases of 1:1. The interview was conducted on both groups, coal workers and non-coal workers of the Mach, Bolan district in Balochistan, Pakistan and facts documented in the survey form and Spirometry was done for coal workers and non-coal workers individually, FVC (Forced Vital Capacity), FEV1 (Forced Expiratory Volume in One Second), PEFr (Peak Expiratory Flow Rate), FEV1/ FVC ratio and FEF<sub>25-75%</sub> (Forced Mid Expiratory Flow), exposed and explored.

**Statistical Analysis:**

The percentage, frequency, mean and standard deviation were detected for coal workers and non-coal workers. Friedman's two-way analysis trial was practical and ( $p < 0.05$ ) was detected via SPSS 22.

**Ethical Consideration:**

Research was accepted through the Research and Ethics Committee, Faculty of Pharmacy and Health

Sciences, University of Baluchistan, Quetta, Pakistan. Prior approval form was taken from all the study respondents; coal workers and non-coal workers of Mach, Bolan district in Balochistan, Pakistan.

**Result:**

Coal worker; total seventy two males coal worker were nominated out of which 20-29 years of age group were 31 (43.05%), 30-39 years age group were 26 ( 36.11%), between 40-49 years of age group were 7 (9.72%) and age group 50 &> years were 8 (11.11%) as shown in table 2. The cigarette smokers were 22 (30.55%) and non-cigarette smokers were 50 (69.45%). The mean $\pm$ sd of age was 32.59 $\pm$ 12.06, mean $\pm$ std of height (m) was 167.59 $\pm$ 8.150, weight (kg) was 71.40 $\pm$ 18.09, BMI was 25.26 $\pm$ 5.02, pulse rate was 88.03 $\pm$ 18.26, mean $\pm$ std of systolic blood pressure was 129.34 $\pm$ 18.79 and diastolic blood pressure was 87.76 $\pm$ 20.75 as in table no 1.

Non-coal workers; total seventy two males non-coal workers were selected out of which age group between 20-29 years were 47 (65.27%), age group between 30-39 years were 19 ( 26.38%) , age group between 40-49 years were 5 (6.94%) and age group 50 &> years were 1 (1.38%) as shown in table 2. The cigarette smokers were 3 (4.16%) and non-cigarette smokers were 69 (95.83%). The mean $\pm$ sd of age was 32.59 $\pm$ 12.06, mean $\pm$ std of height (m) was 167.59 $\pm$ 8.150, weight (kg) was 71.40 $\pm$ 18.09, BMI was 25.26 $\pm$ 5.02, pulse rate was 88.03 $\pm$ 18.26, mean $\pm$ std of systolic blood pressure was 129.34 $\pm$ 18.79 and diastolic blood pressure was 87.76 $\pm$ 20.75 and as shown in table no 1.

**Table No.1: Demographic Characteristics**

Description	Smokers N (Percent)	Non- Smokers N (Percent)	Age in Year	Height (m)	Weight (kg)	BMI	Pulse Rate	Systolic (B.P)	Diastolic (BP)
<b>Coal Workers</b>									
N	22 (30.55%)	50 (69.45%)	72	72	72	72	72	72	72
Mean	---	---	32.59	167.59	71.40	25.26	88.03	129.34	87.76
Std. Deviation	---	---	12.063	8.150	18.09	5.020	18.261	18.797	20.755
<b>Non-Coal Workers</b>									
N	3 (4.16%)	69 (95.83%)	72	72	72	72	72	72	72
Mean	---	---	26.40	172.51	68.31	10.69	92.87	123.57	82.60
Std. Deviation	---	---	7.060	6.39	10.31	45.31	5.138	10.18	9.65

Spirometry relationship among coal workers and non-coal workers as in table no.02; the mean value of FVC in coal workers age group between 20-29 years was 57.03%, whereas the non-coal workers shows FVC mean value about 20-29 years was 62.02%, the FVC mean value in workers age group between 30-39 years was 58.62%, whereas the non-coal workers shows FVC mean value about 30-39 years was 69.94%, the FVC mean value in coal workers age group between 40-49 years was 53.50%, whereas the non-coal workers shows FVC mean value about 40-49 years was 74.50% and the FVC mean value in coal workers age group between 50 &> years was 52.00%, whereas the non-coal workers shows FVC mean value about 50 &> years was 67.00%.

The FEV1 mean value in coal workers age group between 20-29 years was 61.77%, whereas the non-coal workers shows FEV1 mean value about 20-29 years was 71.02%, the FEV1 mean value in coal workers age group between 30-39 years was 64.15%, whereas the non-coal workers shows FEV1 mean value between 30-39 years was 75.89%, the FEV1 mean value in coal workers age group between 40-49 years was 64.50%, whereas the non-coal workers shows FEV1 mean value about 40-49 years was 82.00% and the FEV1 mean value in coal workers age group between 50 &> years was 58.86%, whereas the non-coal workers shows FEV1 mean value about 50 &> was 84.00% as existing in table 2.

The PEFr mean value in coal workers age group between 20-29 years was 79.94%, whereas the non-coal workers shows PEFr mean value between 20-29 years was 83.38%, the PEFr mean value in coal workers age group between 30-39 years was 75.62%, whereas the non-coal workers shows PEFr mean value between 30-39 years was 87.61%, the PEFr mean value in coal workers age group between 40-49 years was 64.17%, whereas the non-coal workers shows PEFr mean value between 40-49 years was 85.75% and the PEFr mean value in coal workers age group between 50 &> years was 64.43%, whereas the non-coal workers shows PEFr mean value between 50 &> years was 84.00% as existing in table 2.

The FEV1/FVC ratio mean value in coal workers age group between 20-29 years was 110.28%, whereas the non-coal workers shows FEV1/FVC ratio mean value between 20-29 years was 114.72%, the FEV1/FVC ratio mean value in coal workers age group between 30-39 years was 113.12%, whereas the non-coal workers shows FEV1/FVC ratio mean value between 30-39 years was 110.43%, the FEV1/FVC ratio mean value in coal workers age

group between 40-49 years was 121.96%, whereas the non-coal workers shows FEV1/FVC ratio mean value between 40-49 years was 110.43% and the FEV1/FVC ratio mean value in coal workers age group between 50 &> years was 116.45%, whereas the non-coal workers shows FEV1/FVC ratio mean value between 50 &> years was 125.37% as existing in table 2.

The FEF<sub>25-75</sub> mean value in coal workers age group between 20-29 was 93.81%, whereas the non-coal workers shows FEF<sub>25-75</sub> mean value between 20-29 years was 96.53%, the FEF<sub>25-75</sub> mean value in coal workers age group between 30-39 years was 97.46%, whereas the non-coal workers shows FEF<sub>25-75</sub> mean value between 30-39 years was 102.67%, the FEF<sub>25-75</sub> mean value in coal workers age group between 40-49 years was 81.83%, whereas the non-coal workers shows FEF<sub>25-75</sub> mean value between 40-49 years was 76.25% and the FEF<sub>25-75</sub> mean value in coal workers age group between 50 &> years was 75.86%, whereas the non-coal workers shows FEF<sub>25-75</sub> mean value between 50 &> years was 140.0%, which display that the standards of mean composed groups were dropping in the usual range and significance level ( $p < 0.001$ ) as existing in table no.02.

Table. No 2: Spirometry Evaluation in Different Age Groups

Description	FVC			FEV1			PEFR			FEV1/FVC			FEF25-75			Friedman's Two-Way Analysis of Variance by Rank (1)
	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	P-Value
<b>Coal Workers Age Group</b>																
20-29 years	31	57.03	15.58	31	61.77	5.77	31	71.94	23.41	31	110.28	15.13	31	93.81	27.19	0.001
30-39 years	26	58.62	19.42	26	64.15	16.47	26	75.62	22.14	26	113.12	15.88	26	97.46	35.58	0.001
40-49 years	7	53.50	15.73	7	64.50	16.88	7	64.17	20.09	7	121.96	13.43	7	81.83	20.56	0.001
50 & > years	8	52.00	16.47	8	58.86	13.70	8	64.43	24.81	8	116.45	17.71	8	75.86	35.72	0.001
<b>Total</b>	<b>72</b>	<b>56.81</b>	<b>16.98</b>	<b>72</b>	<b>62.60</b>	<b>15.70</b>	<b>72</b>	<b>71.89</b>	<b>22.68</b>	<b>72</b>	<b>112.95</b>	<b>15.58</b>	<b>72</b>	<b>92.34</b>	<b>31.14</b>	<b>0.001</b>
<b>Non-Coal Workers Age Group</b>																
20-29 years	47	62.02	12.12	47	71.02	13.32	47	83.38	14.73	47	114.72	2.94	47	96.53	27.18	0.001
30-39 years	19	69.94	14.83	19	75.89	14.62	19	87.61	12.33	19	111.78	20.52	19	102.67	19.37	0.001
40-49 years	5	74.50	5.74	5	82.00	5.41	5	85.75	7.274	5	110.43	9.04	5	76.25	15.77	0.001
50 & > years	1	67.00	0.00	1	84.00	0.00	1	84.00	0.0	1	125.37	0.00	1	140.0	0.00	0.001
<b>Total</b>	<b>72</b>	<b>64.84</b>	<b>13.09</b>	<b>72</b>	<b>73.09</b>	<b>13.55</b>	<b>72</b>	<b>84.61</b>	<b>13.71</b>	<b>72</b>	<b>113.87</b>	<b>10.83</b>	<b>72</b>	<b>97.57</b>	<b>25.61</b>	<b>0.001</b>

**DISCUSSION:**

In this study the evaluation of lung function through spirometry in a group of coal workers and non-coal workers were observed.

The mean vale for FVC group of coal workers for all age groups was 56.81 but in the non-coal workers mean vale for FVC in all age groups was 64.84. The both groups mean values falls below the standard value i.e. >80%, but the mean value between non-coal workers group was better than the coal workers group. The mean vale for FEV1 group of coal workers for all age groups was 62.60 but in the non-coal workers mean vale for FEV1 in all age groups was 73.09. The mean value between non-coal workers group was improved than the coal workers group.

The mean vale for PEFR group of coal workers for all age groups was 71.89 but in the non-coal workers mean vale for PEFR in all age groups was 84.61. The PEFR mean value in coal workers decrease than the

non-coal workers. The mean value of coal workers fall in below the standard value but the in the non-coal workers the mean value fall in between the standard value. The mean vale for FEV1/FVC % group of coal workers for all age groups was 112.95 but in the non-coal workers mean vale FEV1/FVC % in all age groups was 113.87. The predicted mean values of both groups were mostly similar. The mean vale for FEF25-75 group of coal workers for all age groups was 92.34 but in the non-coal workers mean vale FEF25-75 in all age groups was 97.57, the value of both groups in between the standard but the non-coal workers improved than coal workers.

The study was conducted at USA in 1995, the predicted mean value for FEV1/FVC % miners was 106.8 and non-miners 103.8 [19]. But in the present study the mean vale for FEV1/FVC % group of coal workers for all age groups was 112.95 but in the non-coal workers mean vale FEV1/FVC % in all age groups was 113.87. Which shows that the mean value

for FEV1/FVC % of present study improved than the recent study.

The study was conducted in USA by M-L Wang in 2005, concluded that the FEV1/FVC % mean value for miners was 84.8 and for referents the value was 89.0 [20]. But in the present study the mean value for FEV1/FVC % group of coal workers for all age groups was 112.95 but in the non-coal workers mean value FEV1/FVC % in all age groups was 113.87. Which shows that the result of present study contradictory with the result of recent study.

The study was conducted by William N. ROM in 1980, the mean value of FVC was (105.8), FEV1 was (100.8), FEV1/FVC was (76.1) and FEF<sub>25-75</sub> was 110.4 [5]. But in the present study the mean value of FVC in the coal workers was (56.81), the mean value of FEV1 was (62.60), the mean value of FEV1/FVC was (112.95) and the mean value of FEF<sub>25-75</sub> was (92.34). The mean value of FVC and FEV1 in present study the mean value were below the standard. The mean value of FEV1 in the present study was normal and the mean value of FEF<sub>25-75</sub> in both recent and present study fall in standard value but the mean value of FEF<sub>25-75</sub> in the present study was lower than the recent study.

### CONCLUSION:

This study was determined that no significant difference found between coal workers and non-coal workers. The both group's values shows typically similar result, but the lung function of non-coal workers group was better than the coal workers group. The mean value of PEFR, FVC and FEV1 were clearly decreased in coal workers than non-coal workers which should be noticed and if it decreased to 50% or lesser than coal workers should be hospitalized in time. More future researches recommended for the safety of coal workers.

### Conflict of Interest:

The author(s) stated that they have no clash.

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