

**Lactate dehydrogenase level, oxygen saturation and haematological parameters among workers exposed to dust of coal mines in Northwest**

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**Abstract**

**Introduction:** LDH levels are also known to be raised in obstructive airways disease such as bronchial asthma exacerbations acute bronchitis and COPD. In bronchial asthma rise is predominantly in LDH-3 and LDH-5. In the same study the predominant isoenzymes in the lung tissue were found to be LDH-3 and LDH-4

**Methods:** The study was conducted at coal mining sites at various plants in north west Rajasthan. A total of 50 subjects workers and 50 healthy control from general population took part in the study. Data on the subject's years of exposure was deduced from individual worker. Smokers, alcoholics and people with chronic illness were excluded from the study.

**Results:** Mean age of cases was 24.36±5.36 yrs and control was 23.35±5.02 yrs. Maximum patients were male belong to rural area and Hindu. Mean weight of cases was 62.39±8.23 kg and control was 64.13±7.86 kg.

Maximum patients were belong to joint family and SES class III. Mean duration of working in cases group was 5.12±1.12 yrs. Mean value of serum LDH levels in the workers was (453.13 ± 130.12 IU/liter), and in control group was (213.29 ± 80.12 IU/liter). The mean value of oxygen saturation in workers was 84.63±4.12 (%) and in control group was (97.12±1.23 (%)). The mean value of RDW in workers was 13.67 ± 1.12 higher than the value in control group 13.02± 0.36. The mean corpuscle hemoglobin was 33.12 ± 2.13 in workers and 29.13 ± 2.12 in control group. The mean Hb value in workers was 15.01 ± 2.31, whereas the mean in control group was 16.32 ± 2.01.

**Conclusion:** The current study revealed that the serum LDH levels, eosinophils, and neutrophils percentage were higher and SpO<sub>2</sub>, Hb content, and WBCs count were lower in workers than in the healthy control group.

**Keywords:** LDH, SpO<sub>2</sub>, Smokers, alcoholics.

## Introduction

Coal, a nonrenewable source of energy, has been an important component of the world's energy structure for a very long time. Since 1971, total worldwide coal production and coal consumption has grown by more than 150%.<sup>1</sup>

According to the International Energy Agency, the proportion of coal in primary energy reached 29.03% in 2012, and it was predicted that by 2035, the proportion of coal will still be higher than 24%.<sup>2</sup> In the United States, coal was the second-largest energy source (30%) for electricity generation in 2017. And in 2017, coal production was 702.49 million tons, which was 6.32% higher than it was in 2016. All these figures imply that coal is still the main energy source in the world in terms of promoting economic development.<sup>3</sup>

Currently, surface mining and underground mining are the main methods of mining coal. The selection of mining method is mainly determined by the burial depth of coal seams, density and pressure of the overlying strata, and thickness of the coal seams. No matter which method is used, coal mining always raises many health issues.<sup>4</sup>

One of the important issues involved in coal mining is coal dust, which can lead to a series of health problems. Nearly the whole mining processes is accompanied by coal dust generation. The dust generation during mining, showing that dust is generated during coal cutting, transportation and preparation processes.<sup>5</sup>

## Materials And Methods

**Study Design:** Case Control study.

**Study Place:** Department of Physiology, S.P. Medical College and P.B.M associated group of Hospital, Bikaner.

**Sample size:** 50 Case and 50 control Sampling

**Method:** Simple Random Sample.

## Inclusion criteria

- All Workers in age group 25 to 50 years,
- Working in coal mining for at least last 5 years

## Exclusion Criteria

- Workers less than 25 year
- Greater than 50 years
- Working in coal mining for at less than 5 years
- Smokers, alcoholics and people with chronic illness
- Workers not willing to participate.

## Data Collection

The study was conducted at coal mining sites at various plants in north west Rajasthan. A total of 50 subjects workers and 50 healthy control from general population took part in the study. Data on the subject's years of exposure was deduced from individual worker. Smokers, alcoholics and people with chronic illness were excluded from the study.

Blood samples (10ml) were collected from the subjects for hematological parameters. Various parameters such as haemoglobin (HB) estimation, white blood cell count (neutrophils, eosinophils, basophils, lymphocytes and monocytes), platelet counts and packed cell volume (PCV) were estimated.

## Data Analysis

Mean values for the different data collected in the appropriate groups were calculated and differences between means were separated by one way ANOVA. The data analysis was done using SPSS for windows version 21 (SPSS Inc, Chicago .IL). Results were prepared as mean  $\pm$  SEM in tables.

**Observation**

Table 1. Socio-demographic profile

Variable	Case	Control	p-value
Age in yrs	24.36±5.36	23.35±5.02	0.239
Male : Female	50:0	50:0	0.99
Rural : Urban	45:5	43:7	0.325
Hindu : Muslim	52:8	50:10	0.210

Mean age of cases was 24.36±5.36 yrs and control was 23.35±5.02 yrs.

Table 2: Lab test wise distribution of study subjects

Variable	Case	Control	p-value
LDH (IU/liter)	453.13±130.12	213.29±80.12	0.001
Mean oxygen saturation	84.63±4.12%	97.12±1.23%	0.001

It can be observed that the mean value of serum LDH levels in the workers was (453.13 ± 130.12 IU/liter), whereas the mean values of serum LDH levels in control group was (213.29 ± 80.12 IU/liter). The statistical analysis showed that there was significant increase in the mean values of serum LDH levels (P=0.00) in the workers. The mean value of oxygen saturation in workers was 84.63±4.12 (%), whereas the mean value in control group was (97.12±1.23 (%)). a significant decrease in the oxygen saturation level (SpO2) of workers (P=0.001).

Table 3. Total and red blood corpuscle indices wise distribution of study subjects

Parameters	Case		Control		p-value
	Mean	SD	Mean	SD	
RBC (10 <sup>12</sup> /ml)	5.31	1.23	5.77	0.77	0.231
Hb (gm/dl)	15.01	2.31	16.32	2.01	0.02
HCT(%)	45.12	2.30	46.12	2.19	0.126
MCV(fl)	85.01	5.23	83.01	5.12	0.123
MCH(pg)	33.12	2.13	29.13	2.12	0.031
MCHC (gm/dl)	37.12	2.01	34.12	2.10	0.13
RDW(%)	13.67	1.12	13.02	0.36	0.02

The hematological parameters revealed a significant increase at (P<0.05) in both groups in the mean red cell distribution width (RDW). The value in workers was 13.67 ± 1.12 higher than the value in control group 13.02± 0.36. In addition, the mean corpuscle hemoglobin (MCH) was 33.12 ± 2.13 in workers and 29.13 ± 2.12 in control group. Also the results showed a significant decrease at (P<0.05) of hemoglobin

concentration (Hb content). The mean value in construction workers was 15.01 ± 2.31, whereas the mean in control group was 16.32 ± 2.01. However no significant difference was observed for the mean of red blood cells (RBCs) count, the mean hematocrit value (HCT), the mean cell volume (MCV), and mean corpuscular hemoglobin concentration (MCHC) in both groups.

Table 4: Total leucocytes count wise distribution of study subjects

Parameters	Case		Control		p-value
	Mean	SD	Mean	SD	
Total leucocytes count (10 <sup>9</sup> /ml)	5.31	1.23	5.77	0.77	0.01

The results of the study proved that there was a significant difference at (P=0.01) in total leucocyte counts for workers compared to the control group.

**Discussion**

This study was Case Control study conducted at Department of Physiology, S.P. Medical College and P.B.M associated group of Hospital, Bikaner on 50 Case and 50 control. The study will be conduct at coal mininingsites at varies plants in north west rajasthan. A total of 50 subjects workers and50 healthy control from general population took part in the study. Data on the subject's years of exposure was deduced from individual worker. Smokers, alcoholics and people with chronic illness was exclude from the study.

LDH is considered as one of the true intracellular enzymes which are found in the blood of normal individuals at levels up to hundred-fold lower than in tissues. The presence of LDH in plasma at a level elevated above normal value suggested an increased rate of tissues destruction. Lung related disorders as possible sources of serum LDH abnormalities have been underreported as rarely measured. In the current study, the mean serum LDH level was significantly higher in construction workers than to control group (P<0.01). These findings are consistent with the observations of Drent et al. (1996) that showed that marked elevations of serum LDH level are highly indicative of pathological conditions in the lungs, such as cell damage or inflammation. Also,the results of the current study are similar to those obtained by Larivee et al. (1990); Cobben et al. (1997); Al-Salhen, (2014) and Pavan et al. (2016), who found increase in serum LDH activity.

Furthermore, some studies have been reported about selected human cells (Akhtar et al. 2010), animal models of evolution (Naimabadia et al., 2016), andthe cytotoxic effect of quartz on lung cells in vitro (Morrisa et al., 2016). Those studies also showed an increase in LDH activity.

On the contrary, our results are not similar to those obtained by Yildrimi et al. (2016). The lactate dehydrogenase (LDH) among marble workers was normal. Crystalline silica increases BAL LDH and the protein levels in later stages of silicosis. Silicosis starts with lung inflammation (Alveolitis and tissue destruction) as a consequence of SL-induced macrophage activation and the release of inflammatory mediators (Fujimura, 2000; Weill et al., 1994). Cellular damage or death from inflammation is associated with the increased release of protein and LDH (Langley et al., 2004).

The extracellular appearance of LDH is used to detect cell damage or cell death. It is released into the peripheral blood after cell death caused by, e.g. ischemia, excess heat or cold, starvation, dehydration, injury, exposure to bacterial toxins, after ingestion of certain drugs, and from chemical poisonings(Hong et al., 2010; Drent et al., 1996)

The current study revealed that the oxygen saturation level (SpO2) was significantly decreased in construction workers more than the controls. The results of the current study are similar to previous studies' results that showed a decrease in oxygen saturation level (SpO2) in Japanese workplace (Jp et al., 2017). Mamo (2016) found the mean value of %

SpO<sub>2</sub> was reduced significantly (P=0.03) in exposed cobblestone workers groups compared to nonexposed groups. Cecunjanin et al. (2016) showed that the worker's group average values of O<sub>2</sub> saturation in children with acute bronchiolitis before treatment were significantly lower than the values measured after the administration of therapy. Exposure to air pollutants has been linked to pneumonia, reduced birth weight, acute respiratory infection (ARI) (Bruce et al., 2000). Oxygen binding to hemoglobin is determined by the partial pressure of oxygen (SpO<sub>2</sub>), PH and hemoglobin concentration and is also affected by the same. Oxygen tension, temperature and organic phosphate also affect it (Lemon et al., 1987).

The hematological parameters revealed significant increase at (P<0.05) in the mean of RDW and the mean of MCH. However, a significant decrease (P<0.05) was observed of Hb content in the construction workers when compared with the control group. In a recent research, Wang et al. (2016) found that the RDW increase in patients with pulmonary embolism. Cecunjanin et al. (2016) also found that in the peripheral blood, there were lower values of erythrocytes, hemoglobin, and hematocrit. Wildman et al. (1976) suggested that the low hemoglobin production is because of exposure to flour dust-induced disturbance of heme-biosynthesis. Moreover, Isselbacher et al. (1992) reported a drop in the mean of corpuscular hemoglobin concentration (MCHC). The same study explained that such drop might be due to reducing of biosynthesis of heme in bone marrow.

### Conclusion

The current study revealed that the serum LDH levels, eosinophils, and neutrophils percentage were higher and SpO<sub>2</sub>, Hb content, and WBCs count were lower in workers than in the healthy control group. Artificial

construction materials were not handled at the facility. No data was provided about the dust density or silica contents since there was no occupational health and safety specialist available at the facility. During working with dust, workers should wear protective masks to prevent inhalation of respirable particles. Unfortunately, in terms of occupational health, safety in our country is still not sufficient.

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