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Short Communication

Effect of Cadmium on Metabolism: A study from Coal Field Area

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ABSTRACT

Occurrence of high rates of respiratory diseases among people in the Mahanadi valley coal fields and South-eastern Coal Field area in Raigarh district in Chhattisgarh is taken for present study. Coal combustion enhances air and water pollution resulting in to metabolic disorders and diseases. Method to identify association we selected 100 cases and estimated metabolic parameter and compared with coal pollutants in their drinking water. High Cadmium concentration is found in the air as well as in blood sample of fishes lies in this area. The certain metabolites were found higher in these fishes. Higher air pollution index due to coal combustion making susceptible to people for metabolic disorder in this area.

Keywords: Air pollution, Cadmium toxicity, Blood, Metabolites, diseases.

INTRODUCTION

Demographically, the study says adverse impacts are especially severe for the elderly persons, children and those persons with respiratory disease [1-3]. Most notable of the health impacts resulting in premature deaths include chronic obstructive pulmonary disease, lower respiratory infections, cerebrovascular disease, ischemic heart disease, cancers of trachea, bronchitis and lung [4]. Of all the pollutants, the public health concerns in India are focused on particulate matter (PM) that contributes to a host of respiratory and cardiopulmonary ailments; increasing the risk of premature death, the study points out [5,6].

Authors suggest the way to forward is to revise the emission standards for coal power plants for particulates and introduce new emission standards for other pollutants, introduce continuous monitoring at the plant stacks, such that the data is in the public domain in real time and enforce the standards with improved impact assessment methods with human health as the primary indicator [7,8]. A business as usual scenario will not do and the analysis shows that aggressive pollution control regulations were necessary.

MATERIALS AND METHODS

Site selection: Two most air polluted area (Nebraska as compared to the coal of Chal coal field area) affected with fly ash and coal combustion were selected for this study.

Sample selection:

1. For cadmium analysis in coal fly ash was directly done from different sites of selected area.
2. 10 mL of blood sample was taken for metabolite analysis from fishes in different ponds and river in this area.

Analysis of cadmium in Cole fly ash:

1. A single-beam atomic absorption spectrometer was used for the measurements.
2. Standard samples for the calibration of solid samples (coal fly ash) were prepared from the certified reference material NIST 1633b (Arsenic conc.= $mgkg^{-1}$).
3. The NIST 1633b material was diluted with α-Alumina (α-Al_2O_3) powder to prepare samples of different concentrations.
4. A matrix modifier was prepared by dissolving palladium nitrate ($Pd(NO_3)_2$, 100 mg L^{-1}) in 40% HNO_3 and distilled water.
5. Standard samples for the calibration of liquid samples were prepared from reference solutions of As_2O_3 (Merck, pro-analysis).
6. The standard arsenic solutions were prepared in 60% HNO_3 and distilled water.
7. The matrix modifier was composed of $Pd(NO_3)_2$ (100mg L^{-1}) in 3.75% HNO_3 and distilled water.
8. Twenty-one objective samples of coal fly ashes were collected from the selected area.
9. To analyze the arsenic concentration in these coal fly ashes, to the samples added $Pd(NO_3)_2$ (100mg L^{-1}),
10. In Spectrophotometer the wavelength fixed at 193.7 nm; slit width is 1.2 nm; lamp intensity is 6.0 mA.

Quantification was carried out by the analysis of the peak area and pyrolytically coated graphite tubes with platform boats were used for sample introduction [9].

Analysis of Metabolites: All the analysis of different metabolite of blood of fish sample in the river and ponds of the affected area were measured by Autoanalyzer.

RESULTS AND DISCUSSION

Abnormalities of Lipoprotein metabolism occur at the sites of production or utilization of lipo-proteins causing various hypo or hypoproteinemia's [10,11]. The most common disease is diabetes mellitus, where insulin deficiency causes excessive mobilization of free fatty acid. Excessive fat deposits constitute obesity [12,13]. Excessive fat deposit is a risk factor in hypertension or NIDDM (Noninsulin Dependent Diabetes Miletus). A Study detail of NIDDM is one case and stray other cases are there [14,15].

Table1. Concentration of metabolites in blood

S No	Metabolite	Experimental findings	Normal Value
1.	ß Hydroxy butyrate	13mmolL^{-1}	< 0.25 mmolL^{-1}.
2.	Acetoacetate	2.8mmolL^{-1}	<0.2mmolL^{-1}
3.	Arterial blood	89mmolL^{-1}	44.7-45.5mmolL^{-1}
4.	. H^+Concentration	pH 7.05]	pH 7.35-7.45
5.	K^+	5.8mmolL^{-1}	3.5-5.0mmolL^{-1}

Table 2. Concentration of Cd in fly ash from Nebraska as compared to the coal of Chhal coal field area.

Components	Sample from Nebrsaka coal field	Sample from Chhal coal field.
Concentration in ppm.		
Cd	5.0	1.5

Right from coal mining, clearing and storing on the open field, soil and water of the area is affected. This influences the plant intake of trace elements and affects the nutritional aspects of human being [16].

Coal combustion enhances air, soil and water pollution – Resulting in to metabolic disorders and disease. Increased concentration of Cd has adversely affected on Zn concentration in the blood and affected the blood parameters and increased the blood glucose levels and hypertension [17, 18].

APPLICATIONS

The present study is based on the fish sample in this area but the results of this study are also applicable for human in the same area. Findings of elevated metabolite concentration of this study may be applicable as put the susceptibility marker for certain metabolic disorder in this area and preventive measures can be applied on the population living in any coal field area of the country.

CONCLUSIONS

Higher air pollution index due to coal combustion making susceptible to people for metabolic disorder in this area.

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