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Assessment of Carbon Monoxide at Traffic Signals, Toll Plazas and in Main Roadside Built Houses and Impact of Its Chronic Exposure on Public Health

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ABSTRACT: A survey based citizen Science research of Carbon monoxide levels was conducted in Navi Mumbai, particularly at various Toll Plazas and Traffic signals. Carbon Monoxide levels were assessed in roadside built houses. Carbon monoxide is a product of incomplete combustion of organic matter due to insufficient oxygen supply to enable complete oxidation to carbon dioxide (CO₂). It was found out that none of the workers included in this study had any idea about the possibility of CO poisoning due to their working conditions. By conducting interviews, it was concluded that people like policeman, Sweepers, and Shopkeepers having shops on the roadside, are not aware of exposure and hazardous effect of carbon monoxide poisoning on health and even what precautions should be taken to prevent themselves from the diseases and health hazards. According to WHO, the permissible level of Carbon Monoxide in the human body is 1-4ppm. Hence the current study was aimed at the assessment of outdoor Environmental air quality in the ambient air with respect to the quantity of carbon monoxide in ppm and its impact on people residing on highways and on main roads as compared to people residing in Interior locations of the roadside. It's a survey based research where a survey of CO was done and it was found out that people residing on the main road or on highways are suffering from many health problems. Most of the people on highways and main road are suffering from heart problems, breathlessness, and fatigues with depression. The level of CO was found to be more than 25 ppm on traffic signals and highways in which the traffic police stays for more than eight hours a day. A maximum policeman and people residing on main roads, near traffic signals and near toll plazas suffer from depression, fatigue, tiredness, forgetfulness, respiratory problems and with high pulse rate and low oxygen levels. Awareness programs were conducted in various societies and handbills were distributed to many policemen for creating awareness about the health implications due to Carbon Monoxide poisoning.

Keywords: Health Implications, Carbon Monoxide, Traffic Signals, Toll Plazas, Road Side Houses.

I. INTRODUCTION

During daily activities, people encounter Carbon Monoxide in a variety of microenvironments like staying in AC for the entire day or more than 8 hours, especially IT people and people with corporate jobs. Traveling on motor vehicles, cooking and heating with domestic gas, charcoal or wood fires as well as in tobacco smoke most of the CO exposure is due to vehicle and the indoor micro environment. Carbon Monoxide is absorbed through the lungs, and the concentration of carboxyhemoglobin in the blood at any time will depend on several factors. Decreased oxygen uptake and the resultant decreased work capacity under maximal excessive conditions have shown to occur in healthy young adults starting at 5% carboxy haemoglobin and several studies have observed small decrease in work capacity at carboxy haemoglobin levels as low as 2.3-4.3% [1,3] These carboxy haemoglobin levels have many health implications like cardiovascular effects like angina and arrhythmia. Carbon Monoxide is responsible for a large percentage of the accidental poisoning said and deaths reported throughout the world each year [2]. Certain conditions exist in both the indoor and outdoor Environments like cooking smoke and vehicular exhaust that cause the small percentage of the population to become exposed to dangerous levels of carbon Monoxide. Outdoor concentrations of CO are highest near the street intersections in congested traffic near exhaust gasses from internal Carbon monoxide absorption in plasma is diffusion-limited and binds 200 to 250 times more avidly to hemoglobin than oxygen, effectively displacing oxygen from heme-binding sites [4]. CO decreases oxygen saturation in a dose-dependent fashion and shifts the oxygen dissociation curve to the left, despite a normal partial pressure of oxygen (PO₂). A leftward shift of the oxygen dissociation curve causes decreased binding of oxygen to hemoglobin. In addition to binding to hemoglobin, 10% to 15% of CO binds to other proteins, particularly myoglobin within cardiac muscle. [5] This binding interferes with oxidative phosphorylation, which is necessary for myocardial contraction and impairs intracellular

mitochondrial cytochrome oxidase function. Chest pain, arrhythmias, hypoperfusion, and myocardial injury/ischemia can occur with moderate exposure.[6] The cardiovascular compensatory mechanisms to maintain O₂ concentration in the brain can be overwhelmed by the hypoxic hypoxia of CO.[7,8] Nonetheless, the formation of COHgb alone does not account for all the pathophysiologic sequelae. In dog studies, Goldbaum and colleagues [9] found that neither the transfusion of erythrocytes containing 80% COHgb nor the intraperitoneal injection of CO gas produced CO toxicity, even though the serum COHgb level was above 50%. Dogs inhaling CO died within 2 hours, with an average COHgb level of 65%. This difference in effect is thought to be related to the compensatory cerebrovascular vasodilation and increased cardiac output to maintain O₂ delivery to the central nervous system (CNS).[10,11] In addition to cardiovascular hypoperfusion, CNS toxicity also occurs from synergistic effects of COHgb-mediated hypoxic stress and intracellular oxidative disruption.[12] Multiple hypotheses explain the mechanism by which CO toxicity leads to cerebral injury. There are acute and delayed neuropathologic changes related to direct CO toxicity (i.e., they are independent of hypoxia-induced injury). Animal models and postmortem human studies suggest that Neurotoxicity is secondary to a massive release of excitatory amino acids, particularly glutamate. Glutamate release triggers an ischemic cascade that causes excessive calcium influx, free radical-mediated injury, and inhibition of antioxidant defenses.[12,13] Carbon monoxide activates neutrophils that produce reactive O₂ species and cause brain lipid peroxidation. Peroxidation leads to the degradation of unsaturated fatty acids and the reversible demyelination of CNS lipids.[14,15] Carbon monoxide increases the production and deposition of peroxynitrite (a potent oxidant) within blood vessel endothelium and brain parenchyma, leading to vascular compromise and cell death in neurons and neuronal cell lines.[16] Reoxygenation injury occurs secondary to the production of partially reduced oxygen species, created during HBO₂ treatment. Oxygen species can oxidize essential proteins and nucleic acids, creating injury similar to reperfusion damage.

II.OBJECTIVES

An equivalent method of measuring ambient air quality is required for acceptance of measurement data.

- 1) To find out the Carbon Monoxide levels at traffic signals in Navi Mumbai
- 2) To find out the Carbon Monoxide levels at Toll Plazas in Navi Mumbai regions.
- 3) To find out the CO levels in roadside houses.
- 4) To correlate the environmental CO levels with the human exposure and their health implications.
- 5) Conclusions and recommendations for protection of human health and Environment.
- 6) To identify the gaps in knowledge concerning the health effects of pollutants.
- 7) To make people aware of the health hazards due to carbon Monoxide poisoning.

III.MATERIALS AND METHODS

Thirty people that were included in the study were all males. The mean age of the study participants was 28 ± 55years. The mean working period of the study participants was on average 6 months.

- 1) Carbon Monoxide levels will be measured at different traffic signals in Navi Mumbai regions.
- 2) Carbon monoxide levels will be measured at different Toll plazas in Navi Mumbai regions.
- 3) Carbon Monoxide levels will be measured in roadside houses.
- 4) The policeman will be interviewed regarding the health issues faced by them and problems faced by them during a traffic jam and due to vehicular exhaust exposure (occupational diseases).
- 5) Fifty people will be interviewed and analyzed for their time of exposure and health issues.
- 6) The public will be made aware of the repercussions of Carbon Monoxide poisoning.

IV.RESULTS AND DISCUSSIONS

Thirty people that were included in the study were all males. The mean age of the study participants was 28 ± 55years. All were non-smokers. The mean working period of the study participants was on average 6 months. Ten roadside employees including a policeman and cleaning people and various shopkeepers had complaints of a headache and fatigue. The most common cause of acute poisoning related deaths in developed nations is CO poisoning and the major source of such deaths stem from general fire-related CO Poisonings. Despite the fact that signs and symptoms of CO poisoning can occur early, they can also appear after several weeks. Eight among 30 people had complaints about skin irritation and skin colouration being dark. Leg painting and fatigues were the symptoms for twenty-two of them. Twelve of them had complaints about memory loss and heart palpitations. In acute CO toxicity, when they had exposure to polluted gases for more duration, causes symptoms like fatigue, signs of upper respiratory tract infections, dyspnea, chest pain, palpitations, lethargy, confusion, depression, hallucinations, agitation, vomiting, diarrhea, abdominal pain, headache, dizziness, confusion, blurred vision, forgetfulness, neurological disorders, and coma may occur. In chronic poisoning, in addition to acute symptoms, cognitive functions impairment and gradually developing psychiatric symptoms may develop.

CONCLUSION

It was found out that none of the workers included in this study had any idea about the possibility of CO poisoning due to their working conditions. Based on the results of this study, it can be concluded that working at indoor carwash facilities carry occupational health hazards. Therefore, workers in such facilities should be aware of using personal protective equipment such as masks as a protective measure. Timely diagnosis and effective treatment can improve outcomes for patients with CO poisoning and its complications. Primary care physicians should be knowledgeable about the signs and symptoms of CO poisoning and its dread complications to facilitate appropriate treatment.

It is very important to alert the employees on such facilities about this health issue. This can be considered as an occupational disease. In this study, the pulse COHb levels of the car washers working at indoor car wash facilities were found to be at levels that can necessitate clinical intervention. It is evident that these workers are subjected to chronic repetitive exposure to CO. Therefore,

caution should be exercised, especially about chronic sequelae. It was found out that none of the workers included in this study had any idea about the possibility of CO poisoning due to their working conditions. Based on the results of this study, it can be concluded that working at outdoor has occupational health hazards. Therefore, workers in such facilities should be aware of using personal protective equipment such as masks as a protective measure.

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