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Synergistic Effect of Air Pollution and Smoking on the Onset Age of Asthmatics in an Industrial Belt

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Abstract: ***The present study aims to ascertain possible correlation and significance of factors like air pollution, smoking and passive smoking on the onset age of asthmatics in an industrial belt. On analyzing data from suitable control groups in a non- industrial belt, it was found a significant lowering of onset age of asthmatics in both sexes.***

Keywords: broncho asthma, smoking, onset age, COPD

1. Introduction

Asthma is an ailment characterized by episodic, reversible broncho – spasm causing an exaggerated broncho - constrictor response to various stimuli, Williams, 1959 [14]. Studies have shown asthma to be a global health concern. In a study of Roycroft, et. al, 2012 [13], asthma has emerged as a common health issue in both developed and developing countries with latter showing > 80% asthma related deaths. As per a report by World Health Organization (WHO) report, asthma may emerge as the third mortality caused by 2020, asthmatics are more vulnerable to Covid-19 complications.

Industrial pollution is a major concern in developing and developed countries. Lee et al, 2002 [10] found air pollution, even, at levels below current standards of Korea, was harmful to sensitive subjects such as asthmatic children. In a non- linear mathematical model, M. Ghosh, 2000 [6] demonstrated an increase in air pollution, resulted in an increase in asthmatic population in the region under consideration. In another study, Deng et. al., 2015 [4] found that high level of pollutants and nature of combined industrial and traffic air pollution in China may contribute to the recent rapid increase of childhood asthma. A more recent study reveals even short term exposure to PM_{10}, $PM_{2.5}$, sodium dioxide, nitrogen and carbon monoxide could trigger hospital visits for asthma in children (Ling Ding, et. al, 2017) [11].

Smoking causes various ailments lie cardiac diseases, COPD, strokes, cancers of lungs, mouth, hardening of the arteries and asthma. Many studies have also shown passive smoking to be harmful too, causing childhood asthma, ear infections and sudden infant death syndrome, along with other adult ailments (S. D. Brown, et al, 2012) [1]. Smoking in youth leads to more cases of asthma.

The present study aimed at ascertaining whether smoking and passive smoking coupled with industrial pollution had any significant synergistic effect the onset age of asthma in individuals irrespective of sex. Also significance of different factors assex or gender of the individual, living conditions and genetic predisposition on incidence and prevalence of asthma in the industrial region was studied.

2. Methodology

The study was conducted by means of random collection of data from 200 subjects, on various parameters, from the residential population of Durgapur, an industrial town with steel industries and small factories, in the Paschim Burdwan district of West Bengal, India, between March2019 to February 2020. It was ensured that every representative of the population had an opportunity to set- in in the conducted study. The results were expected to be very close to population class.

Data was collected in two ways; from house query to estimate general prevalence of asthma and from hospital visits. To understand epidemiological details of asthmatics, patients were sampled after examination of clinical reports from chest department of main hospital of Durgapur Steel City, West Bengal. Informed consent from each patient was taken and also obtained ethical committee clearance. The results were analyzed statistically.

3. Results

The first figure shows the proportion of male and female asthmatics in the studied test and control populations, where **affected individuals are less.** The second figure shows the average age of first asthma attack in susceptible individuals, i.e., smokers and passive smokers in industrial and non-industrial regions. The graphs distinctly show synergistic effects of air pollutionand cigarette smoke **is statistically significant in lowering the onset age in asthmatics, irrespective of gender.**

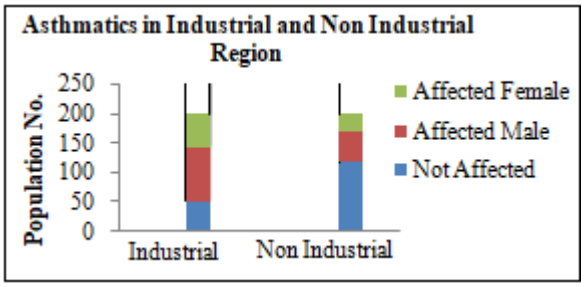

Figure 1

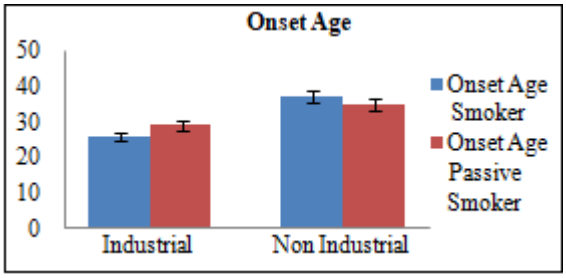

Figure 2

4. Discussion

Bronchial asthma is considered to be a multifactorial condition that is marked by both bronchial hyper-responsiveness and inflammation in the tissues of airways [8].The root causes for the continued increases in asthma prevalence and severity are under debate. Associations of various factors with prevalence, incidence and severity of asthma, as seen from this present study, are discussed below.

A study by a team of researchers of University of Cincinnati [9]shows thirty compounds could be regarded as "air- toxics", which could have the high impact on asthmatics. Out of these particulate matter, ozone, sulphur - di -oxide, nitrogen- di- oxide have emerged as the main culprits. Generally Durgapur air shows poor quality with average 105 AQI, having 83 $PM_{2.5}$, 73 PM_{10}, 66 NO_2 and 10 O_3. This average air quality is unhealthy for sensitive groups. A review article on air pollution and asthma by Jane Q. Koenig, 2019 [9] has concluded air pollution to aggravate asthma in adults and children. Our study has also revealed significant correlation of air pollution and asthma incidences in the industrial area compared to a non- industrial area.

Smoking affects breathing adversely may be due to impaction of smoke particles, predominantly at the bifurcation of respiratory bronchioles, results in the influx of neutrophils and macrophages, both of which secrete clastase [14]. On the other hand, α_1 –antitrypsin, having anti- elastase activity, is inhibited by oxidants in cigarette smoke and oxygen free radicals secreted by neutrophils. Increased elastase secretion together with decreased α_1-antitrypsin activity causes centri-acinar type of emphysema in smokers [14]. Passive smoking has been found to cause various ailments as the tobacco smoke contains about 7000 chemicals, including ammonia, sulphur and formaldehyde. These chemicals are particularly harmful for asthmatics. Our study has found that the onset age of asthma in susceptible subjects is much lower significantly when smoking or passive smoking is coupled with high air pollution than the control group.

Many previous studies have revealed sex or gender of an individual may be a factor in determining the onset age of asthma (Williams, 1959; Graham et. al., 1967; Hall, 1998; Cooksonand Moffat, 2000). However, our study did not justify any such effect.

5. Conclusion

The root causes for the continued increases in asthma prevalence and severity are under research and debate. It is a multifactorial disease and additive effects of pollutants of ambient air are responsible for its onset. Further studfies, especially at gene level, are required to establish the root cause of asthma.

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