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Review Article

Potential Impact of Smog on Human Health

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Abstract

Smog is a term used to describe pollution suspended in humid air. It's made up of different- sized dust particles, as well as non-metal oxides, organic compounds, and heavy metals. Apart from smoking cigarettes, one of the changeable variables leading to the development of respiratory diseases is exposure to toxic compounds dispersed in the air. . Smog is a visible form of air pollution that arises due to the over-emissions of some primary pollutants like volatile organic compounds (VOCs), hydrocarbons, SO, NO, and NO2 which further react in the atmosphere and give rise to toxic and carcinogenic secondary smog components. There are six categories of airborne chemicals that have a negative impact on public health and cause disease. Ozone, particulate matter (PM) of various dimensions - PM2.5, PM2.5–10, PM10, nitrogen – all has important implications. Lead, carbon dioxide, Sulphur dioxide, and carbon monoxide Small dust particles (PM10 and PM2.5) are given special attention since they can enter the lower respiratory tract. The page examines the impact of atmospheric pollutants on both the development and exacerbation of the disease, in addition to detailing the composition of smog and sources of air pollution. Asthma, chronic obstructive pulmonary disease, respiratory infections, and other respiratory tract illnesses can all cause symptoms. Lung cancer is a type of cancer that affects. Some of the legislative methods used in various nations to reduce exposure to harmful air pollution are presented.

Keywords: Smog, Air pollution, Particulate Matter, Respiratory system, Lung disease.

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INTRODUCTION

Smog is a kind of air pollution which is commonly thought to be a mixture of smoke and fog in the air. The word smog was first used in London during early 1950 [1]. Smog is a term for severe atmospheric pollution suspended in humid air. Smog in the atmosphere is caused by human activities and climatic conditions. Activities like the burning of coal in industries, vehicular smoke, crop burning, construction, firework and the smoke of brick kilns are the primary sources that add fundamental particles to the atmosphere for the smog [2]. The global release of smoke from factories and vehicles plays vital role in smog formation which has caused the sever smog pollution [3].

The composition of air pollution is different during the warmer seasons of the year. This sort of smog is known as photochemical smog. Smog, often known as Los Angeles smog, is a type of ozone that predominates in the atmosphere [4]. Is hazardous to human health Exposure to potentially hazardous substances one of the adjustable variables is the substances hanging in the air. Respiratory disorders are caused by a variety of reasons [5].

Smog is a yellowish or blackish hazy air that makes breathing difficult and causes upper and lower respiratory tract ailments and cold and flu due to inflammation of the lung tissues resulting in chest pain, cough and irritation in eyes, while its environmental effects include poor visibility [6]. whole population of the smog area get affected but children, old people and those having cardiac and respiratory issues suffer the most [5]. Photochemical smog, often referred to as "summer smog", is the chemical reaction of sunlight, nitrogen oxides and volatile organic compounds in the atmosphere, which leaves airborne particles and ground-level ozone [7]. Photochemical smog can have an effect on the environment, on people's health and even on various materials.

Table-01: Health effects of pollutants involved in photochemical smog [8].

Pollutant	Effects
Nitrogen oxides	• can contribute to problems with heart and lungs • links to decreased resistance to infection
Volatile organic compounds (VOCs)	•eye irritation • respiratory problems • some compounds are carcinogens
Ozone	• coughing and wheezing • eye irritation •respiratory problems (particularly for conditions such as asthma)
Peroxyacetyl nitrate (PAN)	• eye irritation • respiratory problem

Composition of Smog

When sunlight combines with nitrogen oxides and at least one volatile organic compound (VOC) in the atmosphere, photochemical smog is formed. Car exhaust, coal power stations, and manufacturing pollutants all emit nitrogen oxides. Gasoline, paints, and a variety of cleaning solvents all emit VOCs. When these compounds are exposed to sunlight, they produce airborne particles and ground-level ozone, sometimes known as smog [9]. The solid stuff hanging in the fog is divided into dusts of various sizes. The Environmental Protection Agency (EPA) classifies chemicals into six categories. Substances in the air that have a negative impact on public health and have harmful repercussions for the environment;

These include ozone and other types of particulate matter (PM). PM2.5, PM2.510, PM10, etc. aerodynamic diameters carbon monoxide, nitrogen dioxide, sulphur dioxide, and Particular attention is dedicated to dust particles with a diameter of 10 microns [9]. PM10 and PM2.5 are micrometers and 2.5 micrometers, respectively. The first two are far too massive to go deeply into the body. A lung, despite the fact that, there is a link between their levels and a worsening of cardiovascular and pulmonary conditions is well-known [10]. H eavier pollutants are found in larger dust particles. Organic molecules and heavy metals, for example, are suspended –primarily hydrocarbons like benzopyrene and fluorinated hydrocarbons [11].

Dusts between 10 and 2.5 m are mostly captured in the upper respiratory tract; however, a called respirable dust fraction, i.e. Particles smaller than 5m, is occasionally recognized. Which are able to reach the alveolar air gaps [12]. PM 2.5 is made up of inorganic ions such as nitrates. Residues of hydrochloric acids, as well as alkaline metals potassium and sodium cations, as well as ammonium ions, carbon, both organic and inorganic [13]. Because of the small size they can easily pass through the air vessels so they can harmful impact [14]. Non-metal oxides, namely nitrogen and sulphur oxides are additional important components of smog. Although dangerous in and of itself, nitric oxide II (NO) is useful because of its perished ability. The nitric oxide IV (NO2) has the same importance as the nitric oxide III (NO3).precursor, which is one among the most dangerous pollutants in the atmosphere [15].

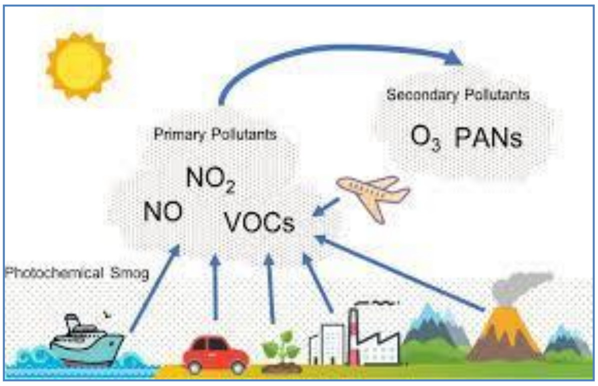

Fig-01: Smog formation [16]

Air pollution sources

Environmental Protection Agency (EPA) has classified information from a variety of industries and gathered it in one location [17]. Carbon monoxide is a poisonous gas (CO). The burning of carbonaceous molecules such as coal, gasoline, and diesel fuels produces this odorless, colorless, and toxic gas. CO bonds to other molecules on the red blood cells hemoglobin and stops oxygen from entering the cell transportation to different areas of the body CO binds to the surface of the cell as well. Terminals oxidize of the cell's electron transport chain the mitochondria shut down and respiration came to a halt. The primary objective of the cardio respiratory system of humans is known as CO body [18].

Heating facilities, particularly classic heaters adapted for the burning of a wide range of materials, including wastes, are a significant and difficult-to-control source of air pollution. Transportation, particularly road transport, is responsible for 57 percent of nitric oxide emissions in Europe, as well as almost 22 percent of carbon monoxide and 20 percent of PM2.5[19].

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The majority of ozone precursors are produced by industry — 1,379, 262 tonnes of non-methane volatile organic compounds (NMVOC) equivalent. In the case of dusts, the disparity between industry and families is not as great; for example, industry released 87,910 tonnes of PM2.5 in 2016, whereas households emitted 59,764 tonnes [20].

In China, air pollution has created a major threat to public health. PM2.5 was identified as one of the key public health concerns in the 2010 Global Burden of Disease Study. Chinese citizens' health is in jeopardy [21]. There are four major sources of air pollution: Cars, buses, planes, trucks, and trains are examples of mobile sources. Power plants, oil refineries, industrial facilities, and factories are examples of stationary sources .agricultural areas, cities, and wood-burning stoves are examples of local supplies. Wind-blown dust, flames, and volcanoes are examples of natural sources [22].

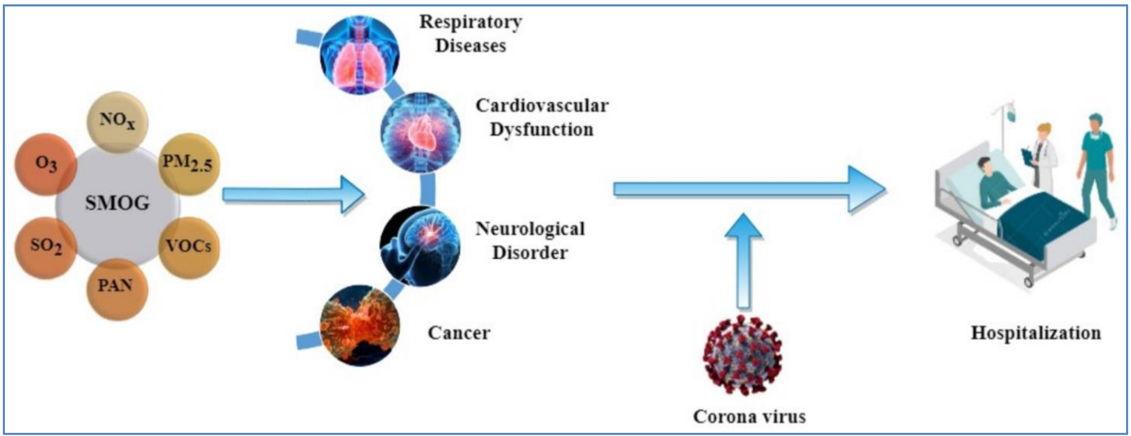

Fig-02: Relationships between smog and respiratory disease [23]

Different types of smog contribute to air pollution. They are London smog (high content of sulfur oxides), Polish smog (PM10, PM2.5, PM1, and various polycyclic aromatic hydrocarbons such as benzo-pyrene), photochemical smog (nitrogen oxides, ozone, hydrocarbons, and VOCs) as shown in Figure 2, and the natural smog released from volcanoes (CO, CO2, SO, H2, and H2S) and plants (hydrocarbons and VOCs) [24, 25]. The activities of erupting volcanoes, traffic emissions, forest fires, general combustion, mining, agriculture are directly or indirectly involved in the production of primary pollutants like NO, NO2 , VOCs, and hydrocarbons which are major forerunners of smog. These primary pollutants undergo chemical reactions in presence of sunlight to form secondary pollutants like formaldehyde, peroxyacetyl nitrate (PAN), and O3 [26, 27]. Both primary and secondary pollutants then concoct smog

Characters	London Smog (Sulfurous Smog)	Polish Smog	Photochemical Smog (Los Angeles Smog or Summer Smog	Natural Smog	References
Definition	Develops due to high concentration of sulfur oxides in the air	When the temperature drops, inversion takes place and a low-level cloud of pollutants form a dusty cloud	It is produced when sunlight reacts with oxides of nitrogen or at least one VOC	It may result due to volcanoes also known as acid smog (vog) and by plants i.e., natural sources of hydrocarbons and volatile organic compounds	[24,25, 28, 29]
Occurrence	It occurs in cold, humid climates	It occurs in the winter seasons	It occurs in a warm, dry, and sunny climate	It occurs mostly in warm, humid, and summer climate	[24,25, 30, 31,32]
Effects	It irritates the eyes, causes bronchitis and lung problems	It affects the lungs, causes asthma and cardiovascular diseases	It irritates the eyes, causes obstructive pulmonary disease, cardiovascular disease, and asthma.	Irritation and inflammation of eyes, dry cough, anterior uveitis, breathing difficulties, asthma, subconjunctival hemorrhage.	[32,33,34]

Smog accounts for a rapid sprout in fatal health problems, including exacerbation of asthma, allergies, eye infections, respiratory tract infections, and cardiac pathologies leading to premature death, higher levels of systolic and diastolic blood pressure in the school children of Lahore, exposed to high levels of air pollution [35].

Effect of smog on respiratory system:

Despite the fact that smog has been shown to have a harmful influence on many organs and systems of the human body, the most vulnerable target – along with the cardiovascular system – is the lungs. The respiratory tract is part of the system. None of the elements are present. The effects of pollution on the respiratory system and lungs are neutral and their actions are differentiated by their mechanisms from direct tissue injury to immunomodulatory complexes mechanisms [36]. Smaller particles, such as PM2.5, are blocked at the level of the upper respiratory tract and have allergic and irritating effects, whereas larger particles, such as PM10, reach the lower respiratory tract and have allergenic and irritating effects [37].

They are dangerous in and of themselves, but they also transport other pollutants into the air, such as heavy metals and hydrocarbons [38]. The gas exchange surface area is large, while the thickness of the gas exchange is thin. A thin 1 m alveolar-capillary membrane the alveolar-capillary membrane is just around 1 m thick and has a large surface area for gas exchange [39].

Fig-03: Effect of smog on respiratory system [27]

Effect of smog on health

PM2.5, nitrogen dioxide, and ozone have the most devastating health effects of all the components of smog, according to experts. According to data from 2005, exposure to PM2.5 reduces the life expectancy of EU people by 8 months on average, resulting in a loss of 3.6 million years every year [39] In terms of health danger, nitrogen dioxide is second, followed by ozone, which is estimated to cause 2100 fatalities in the EU each year [40].

Lung cancer

The importance of ambient air pollution in lung cancer aetiology is apparent. This is owing to the chemical composition of the two substances being similar. Pollution and tobacco smoke, as well as the risk of inhalation [41]. They're in close proximity to the bronchial epithelium. The cancers that appear to be caused by tobacco use on a histopathological level Squamous cell carcinoma and small-cell lung cancer are two types of lung cancer [42]. Sulphates and dusts are also to a greater extent responsible for lung cancer mortality. Nitrogen dioxide appears to be one of the primary carcinogens; however, sulphates and dusts are also to a greater extent responsible for lung cancer deatLung cancer is the leading cause of cancer-related mortality in men and the second most common in women. Lung cancer killed 1.3 million people worldwide annually [43].

There are two main types of lung cancer: one consisting primarily of small cell lung cancer (SCLC) and the other is an (NSCLC) non-small cell lung cancer. The National Cancer Institute (NCI) in the United States found that 215,020 new cases and 161,840 cancer deaths occurred in 2008[44] People who live near the industry areas most worried about industrial air pollution.h. A 10 g/m3 rise in PM2.5 concentration causes a 14 percent increase in death rates [45]. It also offers evidence demonstrating strong links between several subtypes exposure to various chemicals and lung cancer: PM NO2 adeno-carcinoma and small cell lung cancer, 2.5 adenocarcinoma and small cell lung cancer adeno-carcinoma and squamous cell carcinoma caused by ozone [46].

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Fig-04: Effect of smog on lung cancer [47]

Malignancies are also more common in people who have other chronic respiratory diseases that may be exacerbated or exacerbated by air pollution. Patients with a higher morbidity rate COPD is caused by a variety of ethological causes [48]. Patients with a TB history have lung disease. Cancers are twice as common, and it's frequently a glandular cancer. Asthma is another risk factor. The risk of cancer increases day by day up to 70% in smokers [49].

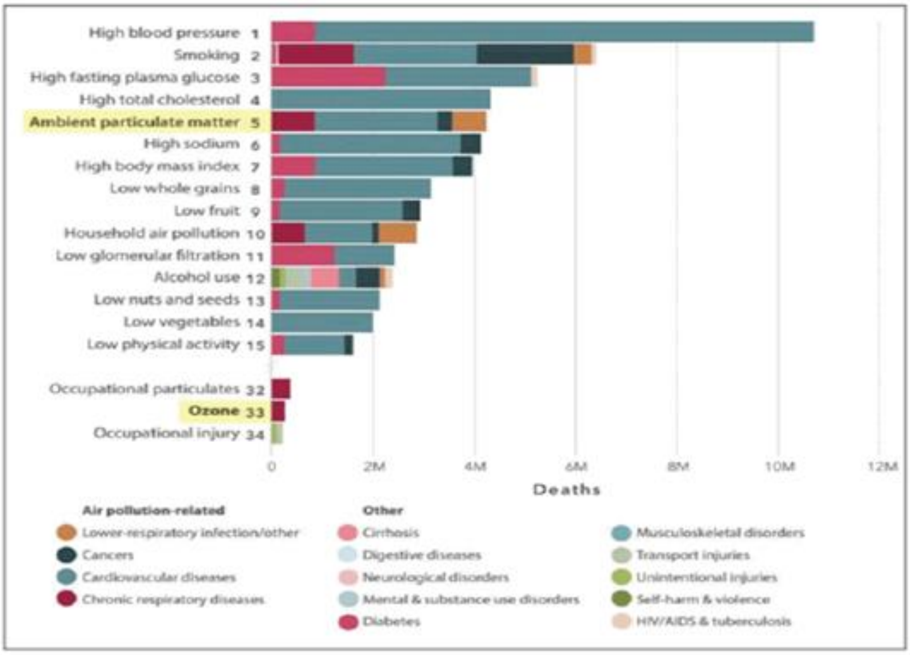

Fig-05: Effect of Smog [50]

CONCLUSION

The impact of Smog on human health, triggering, numerous ailments leading to high morbidity and moralities, predominantly in the developing countries, Therefore because of greater exposure to diverse pollutants in humans, dietary interventions such as organic foods derived from plants may protect different organs from their effects Air pollution has an undeniable harmful impact on the respiratory system. For diverse particles suspended in the respiratory air, the airways constitute the first line of defense. Having explored the link between pollution in the environment and health and a number of respiratory disorders, according to the authors are convinced of the need of taking this into account matter in all of its manifestations Above all, it should be taken into account, both in terms of primary and secondary prevention disorders of the lungs.

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