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Effects of Air Pollution on Human Health

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Abstract

The growing menace of pollution particularly air pollution is becoming a matter of concern day by day. Pollution is the introduction of harmful substances or products into the environment. Air is getting polluted from burning of fuel, from industrial emission etc. There has been several episodes since early 1930's all over the world due to air pollution. Air pollution can adversely effect human health. These are many harmful diseases associated with such extreme air pollution viz., cancer other being several cardiovascular diseases. In the following article several sources of air pollution have been identified in relation to their harmful effect. Both indoor and outdoor pollution have been taken into effect. Considereing the different agents responsible for such menace. Finally some preventive measures have been projected with reference to this dirty pollution.

Keywords: Episodes, Cardiovascular Diseases, Pollutant, Industrial Lung Diseases, Particulate Matter, Smog, PAN.

Introduction

In the 1930s, 40s, and 50s, several episodes of extreme air pollution was observed all over world. Events in the Meuse Valley, Belgium, in December 1930 [1], an episode in Donora, Pennsylvania in 1948[2], and several episodes in London, England[3,4] are the examples of such extreme air pollutions.The sudden large increases in sickness and death that accompanied such episodes demonstrated that air pollution can adversely effect human health. The increased mortality associated with such episodes provided the first quantitative measure of the adverse effects of air pollution.The UK Act in 1956[5], led to reduction in urban pollution. .The causes of the excess deaths were never explained, but it was believed that the problem had been eliminated.Two facts make it necessary to question this assumption: the increase in motor vehicles on roads world-wide with the consequent rise in exhaust emissions, and evidence of continuing associations between air pollution and ill-health. The former has resulted in a change in the type of pollution in cities, and the latter has shown effects on health at levels of pollution previously considered harmless. There are many more harmful diseases associated with such extreme air pollution, as for example cancer which has various type and out of them the most dangerous one is the lung cancer Lung cancer is one of the most common cancers and has a poor prognosis. Active smoking is the main cause, but occupational exposures, residential radon, and environmental tobacco smoke are also established risk factors. Furthermore, lower socioeconomic position has been associated with a higher risk for lung cancer. Ambient air pollution, specifically particulate matter with absorbed polycyclic aromatic hydrocarbons and other genotoxic chemicals, is suspected to increase the risk for lung cancer. Air pollution was responsible in 2015 for 21% of all cardiovascular deaths worldwide, 25% of ischaemic heart disease deaths, 24% of stroke deaths, and 27% of lung cancer deaths. Additionally, ambient air pollution appears to be an important although not yet quantified risk factor for neurodevelopmental disorders in children and neurodegenerative diseases in adults. The good news is that ambient air pollution can be controlled and the diseases it causes prevented. Ambient air pollution is not the unavoidable consequence of modern economic growth.[6] pollution is the release of noxious gases, such as sulfurdioxide, carbon monoxide, nitrogen oxides, and chemical vapors. These can take part in further chemical reactions once they are in the atmosphere, forming smog and acid rain.

Exposures: Humans enter in contact with different air pollutants primarily via inhalation and ingestion, while dermal contact represents a minor route of exposure. Air pollution contributes, to a great extent, to the contamination of food and water, which makes ingestion in several cases the major route of pollutant intake (Thron, 1996). Via the gastrointestinal and respiratory tract, absorption of pollutants may occur, while a number of

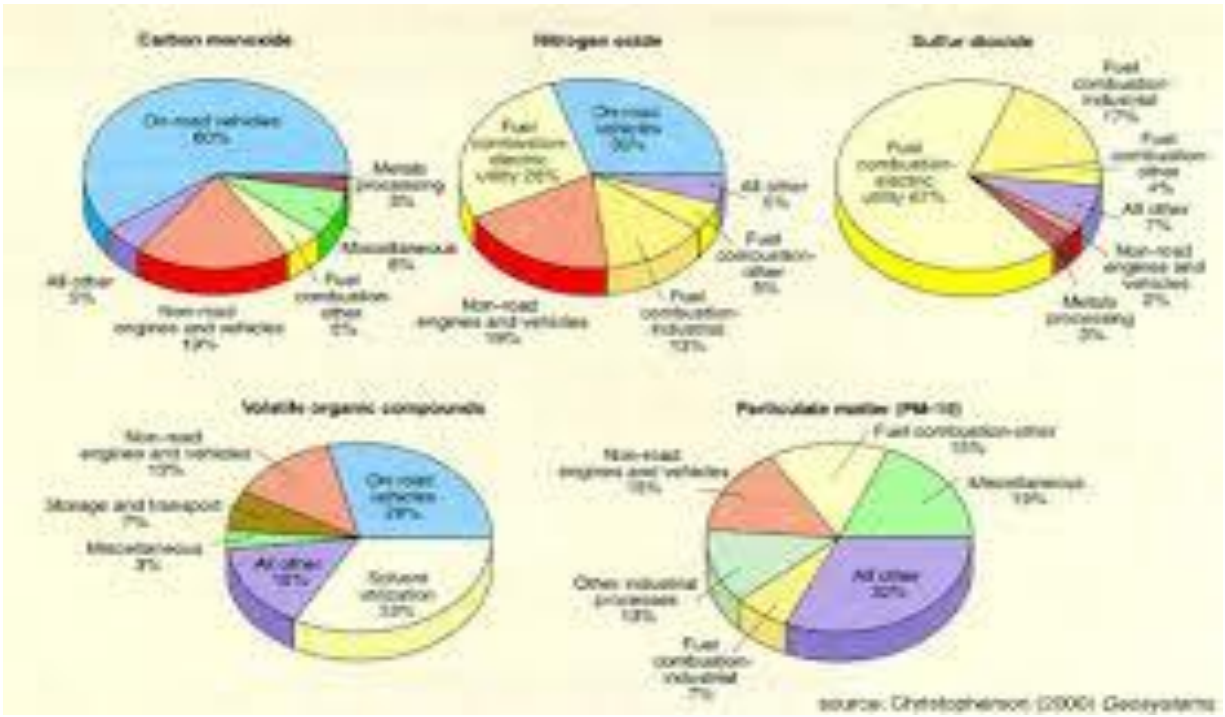
toxic substances can be found in the general circulation and deposit to different tissues. Elimination occurs to a certain degree by excretion [12].

Air pollution exposure [14] is a well-established risk factor for several adverse respiratory outcomes, including airways diseases and lung cancer. Few studies have investigated the relationship between air pollution and interstitial lung disease (ILD) despite many forms of ILD arising from environmental exposures.The long term effect of exposure to air pollution on human health in Europe— which included 36 European areas in which air pollution was measured, land-use regression models were developed, and cohort studies were located. The present study included 17 cohort studies, located in 12 areas, from which information about incident lung cancer cases.

Indoor and Outdoor Air Pollution

A lack of ventilation indoors concentrates air pollution where people often spend the majority of their time. Radon (Rn) gas, a carcinogen, is exuded from the Earth in certain locations and trapped inside houses. Building materials including carpeting and plywood emit formaldehyde (H_2CO) gas. Paint and solvents give off volatile organic compounds (VOCs) as they dry. Lead paint can degenerate into dust and be inhaled. Intentional air pollution is introduced with the use of air fresheners, incense, and other scented items. Controlled wood fires in stoves and fireplaces can add significant amounts of smoke particulates into the air, inside and out[7]. Indoor pollution fatalities may be caused by using pesticides and other chemical sprays indoors without proper ventilation. Carbon monoxide poisoning and fatalities are often caused by faulty vents and chimneys, or by the burning of charcoal indoors or in a confined space, such as a tent [8]. Chronic carbon monoxide poisoning can result even from poorly-adjusted pilot lights. Traps are built into all domestic plumbing to keep sewer gas and hydrogen sulfide, out of interiors. Clothing emits tetrachloroethylene, or other dry cleaning fluids, for days after.

Indoor and Outdoor Air Pollution



There is a large class of pollutants, generated by the buildings themselves or by indoor human activities, which typically have no concentrations of physiological significance in the outdoor air. These include indoor air pollution from smoking, radioactive gases emanating from subsoil, emissions of formaldehyde from particle board, indoor pesticide use, human metabolic gases, The level of radon and its decay products inside conventional buildings is often higher than the ambient level outdoor (Budnitz et al., 1979), and inside poorly ventilated buildings these elements may accumulate to high levels due to the lack of diluting ventilation. Outdoor air pollution is a complex mixture of several pollutants. In 1970, Congress passed the Clean Air Act that established national air pollutant standards for 6 criteria pollutants: ozone, respirable particulate matter (PM), sulfur compounds, lead, carbon monoxide (CO), and nitrogen dioxide (NO2). Since 1970, levels of these pollutants have been regularly measured .**Smog** is a type of large-scale outdoor pollution. It is caused by chemical reactions between pollutants derived from different sources, primarily automobile exhaust and industrial emissions. Cities are often centers of these types of activities, and many suffer from the effects of smog, especially during the warm months of the year.The most important of these outdoor air pollutants in the U.S. today are ozone, PM, and SO_2. Almost all sources of outdoor air contains some pollutants, we are all

probably exposed to some degree. The main route of exposure to outdoor air pollutants is through breathing. However, some of these substances can enter the local ecosystem through various ecological cycles and eventually become pollutants of water, soil, and plants. Children may receive more exposure to these pollutants than adults because of their:

1. Intensity of exposure
2. Time course of exposure (minutes, days, years)
3. The individual's health status

Ozone(O3)	Particulate Matter	Sulfur dioxide	Carbon monoxide	Nitrogen Oxides	Diesel exhaust	PAH
A free radical of oxygen(smog).	Sooty particles that are most toxic when they are small.	Key component of acid rain.	Product of incomplete combustion.	Common pollutant from burning of fossil fuels.	A mixture of particles gases and other chemicals.	Chemical tool of soot.

The National Academy of Sciences stated in its report on indoor pollutants: The constituents of tobacco smoke are well-documented as hazardous, the prevalence of population exposure is very high, and there is an increased incidence of respiratory tract symptoms and functional decrements (decreases) in children residing in homes with smokers, compared with those homes without smokers.

Sources of Indoor Air Pollution

Unprocessed biomass used as cooking fuel cause major air pollution outdoor as well as indoor.Biomass are typically burned in poorly ventilated kitchen using inefficient traditional stoves cause pollution Biomass smoke contains PM, CO, dioxins, and many other toxins –PAHs, VOCs, transitional metal During cooking with biomass the $PM_{2.5}$ concentration near about 468g/ml.

Source	Pollutant Types
1. Ambient air Motor vehicles Roofing tar 2. Building construction materials Concrete, stone Particle board, Plywood Treated lumber Insulation Fire retardants Adhesives Paint. 3. Building contents Heating and cooking combustion appliances Furnishings. 4. Well water. 5. Natural gas. 6. Human occupants Metabolic activity Coughing and sneezing. 7. Human activities Tobacco smoke	1. SOs, NO, NO~, 03, organics, CO, particulates, CO, Pb, Polycyclic organics 2. Formaldehyde Chlorinated hydrocarbons Formaldehyde, glass fibers Asbestos Organics Mercury, organic solvents. 3. CO, NO, NO~ formaldehyde, Particulates Formaldehyde, other organics, mold and fungi 4. Radon. 5. Radon. 6. CO, NH3, odors, excess humidity Microbes. 7. CO, NO~, POM, nitrosamines Particulates, odors, irritants

Unprocessed Biomas Used As Cooking Fuel


Air Pollutants in Biomass Smoke

Effect on Human Health

In 2012, air pollution caused premature deaths on average of 1 year in Europe, and was a significant risk factor for a number of pollution-related diseases, including respiratory infections, heart disease, COPD, stroke and lung cancer[9]. The health effects caused by air pollution may include difficulty in breathing, wheezing, coughing, asthma and worsening of existing respiratory and cardiac conditions. The human health effects of poor air quality are far reaching, but principally affect the body's respiratory system and the cardiovascular system. Individual reactions to air pollutants depend on the type of pollutant a person is exposed to, the degree of exposure, and the individual's health status and genetics [10]. The most common sources of air pollution include particulates, ozone, nitrogen dioxide, and sulfur dioxide. Children aged less than five years that live in developing countries are the most vulnerable population in terms of total deaths attributable to indoor and outdoor air pollution [11]. An estimated 92 percent of the world's population live in areas with dangerous levels of air pollution and, air pollution can increase one's risk of cardiovascular and premature death air pollution causes the premature death of some 7 million people worldwide[13]. India has the highest death rate due to air pollution[12]. India also has more deaths from asthma than any other nation according to the World Health Organization. In December 2013 air pollution was estimated to kill 500,000 people in China each year[14]. There is a positive correlation between pneumonia-related deaths and air pollution from motor vehicle emissions[15].

Annual premature European deaths caused by air pollution are estimated at 430,000[16].An important cause of these deaths is nitrogen dioxide and other nitrogen oxides (NOx) emitted by road vehiclesand chemical factories [17]. In a 2015 consultation document the UK government disclosed that nitrogen dioxide is responsible for 23,500 premature UK deaths per annum[18].Across the European Union, air pollution is estimated to reduce life expectancy by almost nine months[19]. Causes of deaths include strokes, heart disease, COPD, lung cancer, and lung infection

Cardiovascular Diseases

Air pollution is also emerging as a risk factor for stroke, particularly in developing countries where pollutant levels are highest. A 2007 study found that in women, air pollution is not associated with hemorrhagic but with ischemic stroke[20]. Air pollution was also found to be associated with increased incidence and mortality from coronary stroke in a

cohort study in 2011[21]. Associations are believed to be causal and effects may be mediated by vasoconstriction, low-grade inflammation and atherosclerosis[23] Other mechanisms such as autonomic nervous system imbalance have also been suggested [22].

Lung Cancer

The Londonwhere all subjects were 40 to 45 aged from the outlying towns exhibited more severe respiratory symptoms (including cough, phlegm, and dyspnea), reduced lung function (FEV_1 and peak flow rate), and increased sputum production and purulence. The differences were more pronounced for subjects aged 50 to 59. The study controlled for age and smoking habits, so concluded that air pollution was the most likely cause of the observed differences [24]. More recent studies have shown that air pollution exposure from traffic reduces lung function development in children and lung function may be compromised by air pollution even at low concentrations. Air pollution exposure also cause lung cancer in non smokers.

Hindus, Buddhists burn incense sticks and fragrances, offer oil-lit lamps, and burn *dhoop*during daily prayer. Christian's burn candles during prayers and Islamic homes use fragrances. Hindu marriages often involve the burning of a sacred fire with wood for 2 to 3 hours per ceremony .There are 3 million places of religious worship in India alone, and 10 million marriages are performed each year. These all are directly effect our respiratory system causing lung cancer.

Further noted that living close to busy traffic appears to be associated with elevated risks of these outcomes – increase in lung cancer deaths, cardiovascular deaths, and overall non-accidental deaths. The reviewers also found suggestive evidence that exposure to PM2.5 is positively associated with mortality from coronary heart diseases and exposure to SO_2 increases mortality from lung cancer, but the data was insufficient to provide solid conclusions. Another investigation showed that higher activity level increases deposition fraction of aerosol particles in human lung and recommended avoiding heavy activities like running in outdoor space at polluted areas.

Nervous system: The nervous system is mainly affected by heavy metals (lead, mercury and arsenic) and dioxins. Neurotoxicity leading to neuropathies, with symptoms such as memory disturbances, sleep disorders, anger, fatigue, hand tremors, blurred vision, and slurred speech, have been observed after arsenic, lead and mercury exposure (Ewan and Pamphlett, 1996; Ratnaike, 2003). Especially, lead exposure causes injury to the dopamine system, glutamate system, and N-methyl-D-Aspartate (NMDA) receptor complex, which play an important role in memory functions (Lasley and Gilbert, 2000; Lasley et al., 2001). Mercury is also responsible for certain cases of neurological cancer. Dioxins decrease nerve conduction velocity and impaired mental development of children.

Urinary System

Heavy metals can induce kidney damage such as an initial tubular dysfunction evidenced by an increased excretion of low molecular weight proteins, which progresses to decreased glomerular filtration rate (GFR). In addition they increase the risk of stone formation or nephrocalcinosis (Damek-Poprawa and Sawicka-Kapusta, 2003; Jarup, 2003; Loghman-Adham, 1997) and renal cancer (Boffetta et al., 1993; Vamvakas et al.

Natural Protection

In our day-to-day life we are exposed in different kinds of pollutants. Health impacts, as already described above, depend on the pollutant type, its concentration, length of exposure, other coexisting pollutants and individual susceptibility People living in cities are exposed to a greater extent, as a consequence of increased industrialization and demands for energy and motor vehicles. Occupational exposure is also an important factor that should be taken into consideration. During the last decade, health effects of air pollution are studied more in developed countries, while more and better environmental monitoring data are required in order to setup threshold levels. In addition efforts should be intensified by taking the appropriate measures, in order to reduce the possibility of human pollutant exposure.

The human body, in order to protect itself against the potential harmful insults from the environment, is equipped with drug or xenobiotic metabolising enzymes (DMEs or XMEs) that play a central role in the biotransformation, metabolism and/or detoxification of xenobiotics or foreign compounds, including different kinds of pollutants. XMEs include a variety of enzymes such as cytochrome P450 (P450 or CYP), epoxide hydrolase, glutathione transferase, UDP-

glucuronosyltransferase, sulfotransferase, NAD(P)H quinone oxidoreductase 1, and aldo-keto reductase. These enzymes mainly participate in the conversion of xenobiotics to more polar and water-soluble metabolites, which are readily excreted from the body. Finally, it should be noted that, in many cases, the chemically reactive metabolites produced during metabolism, are equally harmful and therefore undergo additional metabolism to inactive products. Hence, the final outcome of a compound modulating the detoxification enzyme systems is the result the effects on the different metabolic pathways.

A number of substances of dietary nature are beneficial, protective, and supportive of good health and the body's own natural chelation mechanisms. They include nutrients with natural chelating properties, which may help to detoxify the body, such as antioxidants, herbs, minerals, essential amino acids, other detoxifying or protective agents, and fiber

Conclusion

This brief review presents the adverse effects of a number of (air) pollutants on human health. It may be caused right from a incense stick uptil a larger scale sponge iron factory.As shown, major impairments of different organs can be observed. The main conclusion drawn is that, in view of increased exposure of humans in a diversity of pollutants, dietary interventions, rich in plant-derived foods, may protect or decrease their effects on different organs. This conclusion is supported by a number of epidemiological studies on the beneficial effect of a Mediterranean-type diet on human health.

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