



Effect of air pollution on human disease: A review

Ali Shaker Sahib Al Hamami* and Laith Abdulrasool Jawad Suraifi

Department of Ecology and pollution, Faculty of Science, University of Kufa, Najaf, Iraq.

*Corresponding author: alishakr20222@gmail.com

Received: March 2nd 2023; Accepted: April 4th 2023

Abstract

Environmental pollution is the disruption of nature and its balance as a result of the quantitative and qualitative change in the natural elements for many reasons, including human activities that directly affect human health and environmental surroundings. The purpose of this review evaluating effect toxic air pollutants on health of human. The toxic air pollutants causes many health endpoints in human such as respiratory disease, asthma, chronic lung disease, respiratory and cardiovascular system dysfunction, decreased immune system, headache, dizziness, gastrointestinal disease and increased risk of cancer (lung, stomach, intestine, eye, liver and brain). There is no doubt that the means of transportation and communication are not devoid of collateral damage and many environmental problems that contribute to what is known as air pollution, which is one of the most important and dangerous problems that all societies face because of the polluting materials that lead to an imbalance in the components of the atmosphere up to the point where the environment does not absorb these materials. Emission large amounts of air pollutants can cause many problems in the environment and human health. The study showed that the main sources for release these pollutants into the atmosphere included fossil fuels combustion, industry, energy production, transportation, heating, brick and cement industry, oil industries, transportation, agriculture fires and dust storms in addition to domestic and public generators.

Keywords: Air Pollution, Health human, Human disease.

Introduction

One of the most important issues at the present time in developed and developing countries alike is air pollution, that due to the effects it causes on the quality of the atmosphere and the resulting great threat on public health (Rakib et al., 2014). Air is a homogeneous mixture of gases and suspended particles that exist in various compositions and sizes, this chemical composition is in a state of continuous change according to place and time as a result to many chemical reactions and physical transformations that affect air quality. In human, breathing process is a continuous process, as the daily intake of air by humans is estimated at about 20 m³/day (Chantara and Sangchan, 2009), compared to the daily intake of water and food (2-4) kg/day, air pollution is of great importance to the humans and other living organisms health (Dey and Mahanty, 2014). Air pollution has great attention by researchers worldwide as many studies proved that exposure to gaseous and suspended particles pollutants associated with lung cancer, respiratory infections, and respiratory and cardiovascular

diseases (Tran et al., 2020). Air pollution is also characterized by its unlimited effect with the place where pollutants are released due to the ability of these pollutants to transfer large distances away from their sources by wind (Kampa and Castanas, 2008). Also because suspended particles include high levels of toxic substances such heavy metals and polycyclic aromatic hydrocarbons, which play an important role in pollution of land and aquatic ecosystems when deposited, and contribute to atmospheric pollution when suspended in air again. Therefore these pollutants do not affect the quality of the atmosphere only, but also the quality of water and soil, which negatively affects the quality and productivity of plants, human life and different animals directly or by the food chain (Mannucci et al., 2015). The most important types of pollutants that negatively affect air quality can be identified as following. Respiratory, and cardio- and cerebrovascular diseases are generally considered associated with air pollution. According to some studies, short-term exposures are the main hazards that exacerbate symptoms or cause acute forms of

diseases, while long-term exposures are probably the main hazards that cause this type of diseases (Bernstein et al., 2004). The consequences of air pollution on public health are measured not only in terms of sickness and death, but also in terms of lost productivity and missed educational and other human development opportunities (Nazar and Niedozytko, 2022). The adverse health effects, such as respiratory morbidity, cardiovascular diseases and mortality, have created a public awareness to the urban air pollution. Evaluations and assessments on health have become more important since they serve as a basis to carry out a reformulation or review on the current air quality.

Sources air pollution: Air pollution sources are divided into natural sources and industrial sources.

1. Natural resources: Air pollution occurs naturally through various pollutants (gaseous-liquid-solid) that enter it and result in it nature and the various natural phenomena without human intervention through his activities that require him to interact with nature Natural air pollution can be limited to the following :dust and dust raised by the wind, active volcanoes that erupt types of harmful gases in huge quantities. From ash and lava, self-natural forest fires, tree and plant pollen, sea and ocean salts, etc (Nazar and Niedozytko, 2022). They are dispersed in the air by winds, storms, and those carried by reducers, atmospheric fronts, and convection currents Thermal, ozone gas produced by photosynthesis in atmospheric air or due to electrical discharges in clouds, particles meteorites coming from space, microorganisms of bacteria and microbes, the formation of some nitrogen oxides When an electrical discharge occurs in thunderclouds, radioactive materials such as those in the soil and some Earth's crust rocks, as well as resulting from the ionization of some gases by cosmic rays (Calderón-Garcidueñas and Ayala, 2022).

2.Industrial sources: It is divided into mobile sources and fixed sources.

Mobile sources include various means of transportation such as cars, vehicles, tires, ships, etc., where they are launched These means in the surrounding air many gases and substances harmful to human health and the environment, such as CO gas and oxides Nitrogen, sulfur oxides, lead bromides and others Chen et al., 2022).

Fixed sources include various industrial facilities such as electric power plants and oil industry facilities .Natural gas, cement factories, fertilizers, dyes, minerals such as gold, etc., and landfills for organic waste and others .Organic waste incinerators..etc.

For example, the oil industry leads to air pollution with oxides of sulfur and nitrogen Ammonia, carbon monoxide, and hydrogen sulfide. By comparing industrial sources with natural sources, no matter how great the natural pollutants are, they are less than industrial pollutants Its quality is less dangerous and has an impact on the vital environment than the type of pollutants created by man in his environment (Gómez-Sanabria et al., 2022).

Effects of air pollutants on different organs and systems:

1.Respiratory system: Numerous studies describe that all types of air pollution, at high concentration, can affect the airways. Nevertheless, similar effects are also observed with long-term exposure to lower pollutant concentrations. Symptoms such as nose and throat irritation, followed by bronchoconstriction and dyspnoea, especially in asthmatic individuals, are usually experienced after exposure to increased levels of sulphur dioxide (Nazar and Niedozytko, 2022), nitrogen oxides , and certain heavy metals such as arsenic, nickel or vanadium. In addition particulate matter that penetrates the alveolar epithelium and ozone initiate lung inflammation. In patients with lung lesions or lung diseases, pollutant-initiated inflammation will worsen their condition. Moreover air pollutants such as nitrogen oxides increase the susceptibility to respiratory infections (Ibrahim et al., 2022). Finally chronic exposure to ozone and certain heavy metals reduces lung function , while the later are also responsible for asthma, emphysema, and even lung cancer . Emphysema-like lesions have also been observed in mice exposed to nitrogen dioxide .

2.Cardiovascular system: Carbon monoxide binds to haemoglobin modifying its conformation and reduces its capacity to transfer oxygen . This reduced oxygen availability can affect the function of different organs (and especially high oxygenconsuming organs such as the brain and the heart), resulting in impaired concentration, slow reflexes, and confusion. Apart from lung inflammation, systemic inflammatory changes are induced by particulate matter, affecting equally blood coagulation (Yazdi et al., 2022). Air pollution that induces lung irritation and changes in blood clotting can obstruct (cardiac) blood vessels, leading to angina or even to myocardial infraction (Joshi et al., 2022). Symptoms such as tachycardia, increased blood pressure and anaemia due to an inhibitory effect on haematopoiesis have been observed as a consequence of heavy metal pollution (specifically mercury, nickel and arsenic). Finally, epidemiologic

studies have linked dioxin exposure to increased mortality caused by ischemic heart disease, while in mice, it was shown that heavy metals can also increase triglyceride levels (Juneja Gandhi et al., 2022).

3.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 (Lukina et al., 2022). 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. Mercury is also responsible for certain cases of neurological cancer. Dioxins decrease nerve conduction velocity and impaired mental development of children (Sîrbu et al., 2022).

4.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 Lee et al., 2022).

5.Digestive system: Dioxins induce liver cell damage, as indicated by an increase in levels of certain enzymes in the blood (see following discussion on the underlying cellular mechanisms of action), as well as gastrointestinal and liver cancer (Pritchett et al., 2022).

Conclusion and recommendations

In conclusion, air pollution poses a significant threat to human health, as it can introduce harmful substances air pollutants into air sources. The major sources of air pollution include natural resources and industrial sources. The outlook for environmental conservation changed by establishing a ministry for the Iraqi environment. It drew up a comprehensive and ambitious program that included various projects in this field to know the most critical environmental problems the country is experiencing and find appropriate solutions and treatments. Concern for the environment and achieving a sustainable balance must be the responsibility and duties of the State on the one hand and civil society institutions on the other, by working to create institutions that work to develop effective policies that balance them. Emphasizing reducing the emission of carbon dioxide and reducing its emissions in proportions consistent with the

atmospheric capacity to absorb it. A certain proportion of the financial resources obtained from exploiting natural resources must be allocated to preserve the environment.

References

- Bernstein, J. A., Alexis, N., Barnes, C., Bernstein, I. L., Nel, A., Peden, D., and Williams, P. B. (2004). Health effects of air pollution. *Journal of allergy and clinical immunology*, 114(5), 1116-1123.
- Calderón-Garcidueñas, L., & Ayala, A. (2022). Air pollution, ultrafine particles, and your brain: are combustion nanoparticle emissions and engineered nanoparticles causing preventable fatal neurodegenerative diseases and common neuropsychiatric outcomes?. *Environmental Science & Technology*, 56(11), 6847-6856.
- Chantara, S., & Sangchan, W. (2009). Sensitive analytical method for particle-bound polycyclic aromatic hydrocarbons: A case study in Chiang Mai, Thailand. *Sci. Asia*, 35(1), 42-48.
- Chen, K. C., Tsai, S. W., Shie, R. H., Zeng, C., & Yang, H. Y. (2022). Indoor air pollution increases the risk of lung cancer. *International journal of environmental research and public health*, 19(3), 1164.
- Dey, S., Gupta, S., & Mahanty, U. (2014). Study of particulate matters, heavy metals and gaseous pollutants at Gopalpur (23°29'52.67" N, 87°23'46.08"E), a tropical industrial site in eastern India. *IOSR Journal of Environmental Science, Toxicology and Food Technology*, 8(2), 01-13.
- Gómez-Sanabria, A., Kiesewetter, G., Klimont, Z., Schoepp, W., & Haberl, H. (2022). Potential for future reductions of global GHG and air pollutants from circular waste management systems. *Nature communications*, 13(1), 106.
- Ibrahim, M. F., Hod, R., Tajudin, M. A. B. A., Mahiyuddin, W. R. W., Nawi, A. M., & Sahani, M. (2022). Children's exposure to air pollution in a natural gas industrial area and their risk of hospital admission for respiratory diseases. *Environmental Research*, 210, 112966.
- Joshi, S. S., Miller, M. R., & Newby, D. E. (2022). Air pollution and cardiovascular disease: the Paul Wood lecture, British Cardiovascular Society 2021. *Heart*, 108(16), 1267-1273.
- Juneja Gandhi, T., Garg, P. R., Kurian, K., Bjurgert, J., Sahariah, S. A., Mehra, S., & Vishwakarma, G. (2022). Outdoor physical activity in an air polluted environment and its effect on the cardiovascular system—a systematic review. *International Journal of Environmental Research and Public Health*, 19(17), 10547.

- Kampa, M., & Castanas, E. (2008). Human health effects of air pollution. *Environmental pollution*, 151(2), 362-367.
- Lee, W., Wu, X., Heo, S., Fong, K. C., Son, J. Y., Sabath, M. B., ... & Bell, M. (2022). Associations between long term air pollution exposure and first hospital admission for kidney and total urinary system diseases in the US Medicare population: nationwide longitudinal cohort study. *BMJ Medicine*, 1(1).
- Lukina, A. O., Burstein, B., & Szyzkowicz, M. (2022). Urban air pollution and emergency department visits related to central nervous system diseases. *Plos one*, 17(6), e0270459.
- Mannucci, P. M., Harari, S., Martinelli, I., & Franchini, M. (2015). Effects on health of air pollution: a narrative review. *Internal and emergency medicine*, 10, 657-662.
- Nazar, W., & Niedoszytko, M. (2022). Air pollution in Poland: A 2022 narrative review with focus on respiratory diseases. *International Journal of Environmental Research and Public Health*, 19(2), 895.
- Nazar, W., & Niedoszytko, M. (2022). Air pollution in Poland: A 2022 narrative review with focus on respiratory diseases. *International Journal of Environmental Research and Public Health*, 19(2), 895.
- Nazar, W., & Niedoszytko, M. (2022). Air pollution in Poland: A 2022 narrative review with focus on respiratory diseases. *International Journal of Environmental Research and Public Health*, 19(2), 895.
- Pritchett, N., Spangler, E. C., Gray, G. M., Livinski, A. A., Sampson, J. N., Dawsey, S. M., & Jones, R. R. (2022). Exposure to outdoor particulate matter air pollution and risk of gastrointestinal cancers in adults: a systematic review and meta-analysis of epidemiologic evidence. *Environmental health perspectives*, 130(3), 036001.
- Rakib, M. A., Ali, M., Akter, M. S., & Bhuiyan, M. A. (2014). Assessment of heavy metal (Pb, Zn, Cr and Cu) content in roadside dust of Dhaka Metropolitan City, Bangladesh. *Int. Res. J. Environ. Sci*, 3(1), 1-5.
- Sîrbu, C. A., Stefan, I., Dumitru, R., Mitrica, M., Manole, A. M., Vasile, T. M., ... & Ranetti, A. E. (2022, June). Air Pollution and Its Devastating Effects on the Central Nervous System. In *Healthcare* (Vol. 10, No. 7, p. 1170). MDPI.
- Tran, V. V., Park, D., & Lee, Y. C. (2020). Indoor air pollution, related human diseases, and recent trends in the control and improvement of indoor air quality. *International journal of environmental research and public health*, 17(8), 2927.
- Yazdi, M. D., Wei, Y., Di, Q., Requia, W. J., Shi, L., Sabath, M. B., ... & Schwartz, J. (2022). The effect of long-term exposure to air pollution and seasonal temperature on hospital admissions with cardiovascular and respiratory disease in the United States: A difference-in-differences analysis. *Science of The Total Environment*, 843, 156855.