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Air Pollution and Health Hazards: A Menacing Situation in Pakistan

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With the increasing urbanization and industrialization around the globe, the problem of air pollution is also increasing exponentially. At one end it is causing depletion of ozone layer and global warming and on the other side responsible for health related issues. It is estimated that around 7 million deaths are taking place due to air pollution per year in the whole world.[1] The effects on human health are not only physical on respiratory tract, nervous system, immune system, cardiovascular system etc but also it can cause psychological disorders and insomnia. There are many types of air pollutant as well as its source of origination which include CO_2, CO, different oxides of nitrogen (NO, NO_2. N_2O), sulphur dioxide, volatile organic compounds (toluene, benzene, ethylbenzene, xylene), formaldehyde, culturable airborne bacteria, ozone (O_3), black carbon and particulate matter.[2]

Particulate matter (PM) in the air is one of the most dangerous air pollutant the world is facing now a days. It is classified according to its size into; PM_{10} which is particulate matter of less than 10 µm, $PM_{2.5}$ having size less than 2.5 µm and PM_1 having size less than 1 µm. Similarly the source of origin for these particulate matter also varies widely from both natural and human activity based. The natural source of origin may include volcanic and desert dust, sea or ocean aerosol and fire related products. Similarly human activity related particulate matter originates from combustion of different fuels like in house-hold cooking, vehicles or industries.[3] The larger particles PM_{10} remain suspended in the air and usually do not go beyond upper respiratory tract while the smaller sized particles $PM_{2.5}$ may reach to lower respiratory tract till the terminal bronchioles and alveoli. The even smaller particle (PM_1) may cross the epithelial barriers and can reach to blood stream. These smaller particles (PM_1) are associated with more damage to human health than $PM_{2.5}$ and reduce more years from life expectancy.[4] Smog is a special type of air pollution that decreases visibility and the term is derived from two words; smoke and fog. It is mainly produced when the sunlight react with the nitric oxide in the air along with volatile organic compounds (VOC). The main source for nitric oxide in the air is from combustion of fuel and coal.

The problem of air pollution is not only limited to outdoor atmosphere, the indoor air pollutant are also significantly raised as in most studies conducted on indoor air quality.[5] Faulty air conditioning system and lack of proper ventilation are the main cause for indoor pollution, as these pollutants are re-circulated again and again. The indoor pollutants are mainly derived from paints, furniture, electrical appliances, cleaning supplies, smoking and cooking. Many studies show that concentration of the formaldehyde in indoor air is quite raised and is mainly formed by paints, furniture, flooring etc. In major cities of Pakistan, corporate offices, shopping malls/plazas and even small shops and houses are utilizing central air conditioning system. Proper attention to cleaning of these air conditioning system is not paid, resulting in reduced indoor air quality level.

Many international agencies surveys show that air quality index of many cities of Pakistan have pollution well above the WHO standards. However, there are limited scientific studies available in the literature. One recent study conducted in the Lahore city shows alarmingly higher levels of all air pollutant including $PM_{2.5}$, PM_{10}, formaldehyde and volatile organic compounds in the busiest residential and commercial area.[5] Another study conducted in Peshawar also shows that concentration of nitrogen dioxide (NO_2) and particulate matter were elevated well above the normal levels.[6] More scientific studies are required in this regard in different rural and urban area of Pakistan. Recently, newspapers are packed with headline news of heavy smog affected areas in different cities of Punjab including Lahore. The outrageous rise in vehicles, unchecked urbanization, uncontrolled growth of industries and vast deforestation are the main factors responsible for this alarming situation in Lahore.[7] Government has imposed many restrictions to reduce smog in Lahore city like declaring Monday as a routine weekly holiday with Saturday and Sunday, 50% attendance in offices and 50% work from home.

Recently, the world has seen a harmful and lethal pandemic in the form of COVID-19. The transmission, morbidity and mortality of COVID-19 has been associated with both individual susceptibility and the ambient environmental conditions.[8] Several studies had shown an association of outdoor and indoor air pollution with transmission of corona

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virus, having direct unfavorable effect and concluded that measures to reduce air pollution will also reduce burden of COVID-19.[9] Exposure, both short term and long term, to the air pollutants like CO_2, NO_2, SO_2, $PM_{2.5}$ are associated with increase in incidence and overall mortality due to COVID-19. However, lockdown imposed globally during this pandemic has positive effect on the air pollution and ambient atmosphere. During lockdown most of the industries were shut down, traffic on road decreased to very low level, offices, shops and malls have limited timings and majority of people were at home, thus reducing emission of toxic gases. Air quality level improved in all areas where the lockdown was very severe and strict. At present, this pandemic is at its lowest level and the world is going back to its normal routine, thus again increasing production of toxic air pollutants. At this time, we have to think again and follow many of the restrictions that we followed during COVID-19 to improve our air quality level.

Tourism is one of the best earning business now a days and many countries of the world are only dependent of it. The tourism industry in Pakistan is also increasing at a good pace especially in northern areas to improve overall economy of our country. Majority of the northern areas of Pakistan are beautiful, natural and raw with an excellent air quality level. But increased tourism and human flow in these areas will affect its natural beauty with increasing production of toxic air pollutants that will harm its air quality level. More road will be developed and more hotels will be raised to cater these tourists and for all these purposes, deforestation is required. Trees are very essential and crucial for maintaining air quality level as it clean the air by absorbing CO_2 and other toxic gases. Though, trees are also affected by air pollution especially particulate matter and black carbon. Deposition of these on the trees lead to inhibition of photosynthesis, protein synthesis and vulnerability to micro-organisms and insects.[10] All should be done to reduce air pollution in these areas because at one end it will destroy and damage environment of these areas and country as a whole and on the other hand will reduce tourism itself. Studies in the developing countries have shown that deteriorating air quality level is the main factor in reducing number of tourists and overall revenue generation.[11]

To conclude, like many countries in the world, Pakistan is also facing a hazard of air pollution and smog especially in urban areas but also increasing in rural and tourist areas. Every effort should be done to constitute rules and implement it to reduce air pollution. Urbanization can be reduced by uplifting the rural areas, so people will not move to cities for financial reasons. Industrial gases and waste emissions must be controlled by proper disposing mechanism. Traffic jams in the cities increases vehicular emission, so unhindered flow of traffic must be ensured. Peoples are encouraged to work from home as far as possible and un-necessary inflow in the offices can be reduced by online services. Deforestation should be controlled by strict actions and further tree plantation derives to be carried out.

Authors Contribution:
Iqbal Hussain Udaipurwala: Substantial contributions to the conception criticaly evaluation of intellectual content, final approval of the version to be published

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