Interlink between pollution and COVID-19 in India: compelling view and key attributes

Srinivasa R. Vulichi¹ · Atul Kabra² · Mohammad Khalid³ · Rupak Kumar⁴ · Natália Cruz-Martins^{5,6,7}

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Abstract

Pollution and pollution-related consequences have a historic reputation, being even considered as chief causative agents behind several tragedies linked to a huge impact on health and environment. Nonetheless, the unforeseen viral outburst has surprisingly led to the recovery of the atmospheric immaculacy, besides to the serious destruction. Thus, here some important aspects related to the impact of pollution on the viral epidemic and vice versa were attempted to be critically discussed.

Keywords Environment · Health · Pollution · Viral infection · COVID-19

Introduction

Over the years, the pollution-induced atmospheric quality has abruptly deteriorated. In fact, despite all the advances achieved, which have been remarkable for human development and fully accessible, it is still not possible to clearly realize the self-destruction that grows prodigiously around us. Meanwhile, much of the globe has been adversely affected by the unforeseen outbreak of the coronavirus disease (COVID-19) (Kanniah et al. 2020; Muhammad et al. 2020). However, the world has never been in such an impressive environmental tranquility as it actually is. This change can certainly be attributed to the COVID-19 outbreak. In fact, this condition has shaken the world so abruptly that people are

forced to strictly block most routine activities (Kanniah et al. 2020; Muhammad et al. 2020). The practice of social detachment and confinement at home became the last resort for protection and survival from the virus.

A Columbia University research found that the levels of carbon monoxide (CO) and carbon dioxide (CO₂) drop to 50% and 10%, respectively, in New York, during March 2020 (Balaji 2020). In fact, satellite images from the European Space Agency made it clear, with levels of fine particulate matter (PM_{2.5}) dropping noticeably in most European countries during the viral outbreak (Balaji 2020).

Undoubtedly, Mother Nature has been greatly spared, which is evident from the facts that the air quality index (AQI) of the National Capital Region (NCR, India) has

Responsible Editor: Philipp Gariguess

✉ Natália Cruz-Martins
ncmartins@med.up.pt

Srinivasa R. Vulichi
nivschem@gmail.com

Atul Kabra
atul.kbr@gmail.com

Mohammad Khalid
drkhalid8811@gmail.com

Rupak Kumar
rupakraman@gmail.com

¹ Sri Venkateswara University College of Pharmaceutical Sciences, SV University, Tirupati, India

² School of Pharmacy, Raffles University Neemrana, Neemrana, Alwar, Rajasthan 301705, India

³ Department of Pharmacognosy, College of Pharmacy, Prince Sattam Bin Abdulaziz University, Al-Kharj 11942, Saudi Arabia

⁴ CDSCO, FDA Bhawan, New Delhi, India

⁵ Faculty of Medicine, University of Porto, Alameda Prof. Hernani Monteiro, 4200-319 Porto, Portugal

⁶ Institute for Research and Innovation in Health (I3S), University of Porto, Rua Alfredo Allen, 4200-135 Porto, Portugal

⁷ Laboratory of Neuropsychophysiology, Faculty of Psychology and Education Sciences, University of Porto, Porto, Portugal

dropped sharply to 93 in March 2020 (from 161 in March 2019), which is unforeseen in the history of NCR-AQI. Experts from the Copernicus Atmosphere Monitoring Service (CAMS) expressed optimism regarding ozone healing at the Antarctic region, pertaining to the reduction of environmental pollution (Bao and Zhang 2020). On the other side, and keeping in mind the erratic escalation in the COVID-19 incidence and the huge increase in morbimortality rates, China has instituted a strict lockdown in January 2020, in Wuhan and other cities, mitigating air pollution in these regions (Bao and Zhang 2020). Indeed, it was inferred by a quantitative study addressing the extent of air pollution between January 1 and March 21 in 44 cities from northern China that the average AQI was reduced by 7.80%. In addition, the array of major air pollutants, like sulfur dioxide (SO₂), particulate matter (PM_{2.5}, PM₁₀), nitrogen dioxide (NO₂), and CO, decreased by 6.76, 5.93, 13.66, 24.67, and 4.58%, respectively (Bao and Zhang 2020). Moreover, a comparative study of the pre- and post-lockdown influence on the levels of various air pollutants in Almaty (Kazakhstan's largest city) revealed a decrease in PM_{2.5} concentration by 21%, with a spatial variation of 6 to 34% when compared to the year 2018–2019. In contrast to the 17 days prior to the lockdown, the CO₂ and NO₂ concentrations were also reduced to 49 and 35%, respectively, along with a 15% increase in ozone levels (Kerimray et al. 2020).

On the other side, water is a prominent component among the various natural resources available and is also considered the “elixir of life.” Certain categories of water sources, like groundwater and surface water, are highly susceptible to several chemical and biological pollutants, which adversely affects their quality. The statement “Unsafe water kills more people each year than war and all other forms of violence combined” stands ever-appreciating (Denchak 2018). In fact, the revival of surface water quality in the Vembanad lake (longest freshwater lake in India) has been correlated with the lockdown period. When compared to pre-lockdown conditions, the turbidity algorithm of the Landsat-8 OLI images illustrated an average reduction in the concentration of suspended particulate matter (SPM) by 15.9% (Yunus et al. 2020). The subsequent phases from the first lockdown phase have leveraged the status of the Ganga river and its tributaries, with an improvement in dissolved oxygen (DO), biological oxygen demand (BOD), and chemical oxygen demand (COD), respectively (Sharma 2020). In Varanasi, DO increased from 3.8 to 6.8 mg/L, with an improvement of 79% in April 2020 (Singhal and Matto 2020). Indeed, it is extremely astonishing to realize that Ganga water, from Devprayag to Har Ki Pauri, attained the “A” category, which even the Ganga's cleaning project has failed to achieve in the last three decades (Upadhyay 2020). The most probable number (MPN/100ml), a parameter to confirm the number of viable cells (fecal coliforms) in a sample, has also been nullified in turn,

making the water enough potable (Upadhyay 2020), with the Central Pollution Control Board (CPCB) attributing this to a reduction in industrial and domestic wastes' discharge. In addition, it became clear that Yamuna's water purity status was also greatly improved during the lockdown, with people located in the surrounding regions claiming to increase the water clarity and quality (ANI 2020). In addition, and taking into account the accumulation of well-documented plastic into water bodies, the evidence of unmanaged face masks and gloves in the environment, and the erroneous practices of society in general, not only in everyday life but in particular in this COVID-19 outbreak, the statement “The Coronavirus is the earth's vaccine, we are the virus” must certainly be acknowledged (Singhal and Matto 2020).

Bringing the aspects of biodiversity into the picture, the positive impact of COVID-19 on the environment has become even clearer (Conservation International 2020). Since the news of COVID-19 appeared, the print media overflowed with the relocation of several endangered species in their natural habitats (Conservation International 2020), such as the nilgai was spotted walking in and around Noida, Uttar Pradesh; the Malabar civet was seen roaming on the roads of Kozhikode, Kerala; and olive ridley turtles returned to happily lay eggs at Rushikulya beach in Odisha, after a massive break.

Birds, like pigeons and sparrows, which would normally be confined to urban parks, are traveling beyond their territories (The Hindu 2020). In addition, several plant species, such as wild orchid, are also being spared from passersby who would pluck when they bloom (The Hindu 2020). Marcelo Giagnoni, head of Chile's agricultural and lives stock service, rightly stated that “This is the habitat once they had and that we have taken away from them” (Business Standard 2020).

To what concerns to the speculation on air pollution as a COVID-19 culprit, it has been well established that air pollution is one of the key etiological factors associated with several typical menacing pathological conditions (Schraufnagel et al. 2019; Manisalidis et al. 2020). Among the various organ systems in the body, the respiratory system is extremely vulnerable to the effect of air pollution, as it acts as a convenient gateway for the entry of various harmful classes of pollutants (Fig. 1), broadly distributed in the surrounding medium. The

Fig. 1 Two main classes of pollutants

Fig. 2 A concise flow depicting the sequential interlink between the long-term exposure to air pollution and COVID-19 susceptibility

individual's physiological defense networks may be frazzled out at some point, leading to severe respiratory collapse through chronic exposure to pollutants (Conticini et al. 2020). Interestingly, some recently published scientific reports have clarified the connection between air pollution and COVID-19 risk (Chauhan and Singh 2020; Fattorini and Regoli 2020; Frontera et al. 2020; Otmani et al. 2020).

The drastic viral outbreak in Wuhan city has subsequently initiated several studies that have actively taking part in addressing the corona conundrums. Among these, the role of air pollution has been widely focused (Chauhan and Singh 2020; Fattorini and Regoli 2020; Frontera et al. 2020; Otmani et al. 2020). Certain rational evidences from countries such as Italy (Bontempi 2020; Fattorini and Regoli 2020), China (Cui et al. 2020; Mehmood et al. 2020), India (Mahato et al. 2020; Selvam et al. 2020; Bera et al. 2020), and the USA (Adams 2020; Chen et al. 2020) may allow us to infer on the relationship between the extent of exposure to pollutants and the susceptibility to COVID-19. It has been observed that immune dysregulation induced by pollution (Fig. 2) may encourage virions to explore vital regions of the respiratory tract, ultimately increasing the mortality rate (Conticini et al. 2020). For instance, two blind parallel analyses carried out to determine the viral genomic identity in 34 particulate matter (PM₁₀) samples collected from Bergamo, in northern Italy, over a period of 3 weeks, selecting 3 specific genes (i.e., E, N, and RdRP) as markers, revealed that out of 34 samples, 20 responded positively to one of the three markers, together with the confirmation of all three regardless in general (Setti et al. 2020). In addition, the other two regions, Lombardy and Emilia-Romagna, in northern Italy, also showed a healthy correlation between pollution intensity and COVID-19 lethality (Conticini et al. 2020). Also, the high atmospheric concentration of NO₂ resulted in 78% of deaths among people confined to 5 regions of northern Italy and Spain (Brandon 2020). A research study conducted by Harvard University demonstrated the role of PM_{2.5} and other factors, such as smoking rates, in amplifying deaths from COVID-19. This has made clear that even the USA, although highly advanced in terms of commercial, economic, social, and healthcare facilities, is not an exception in this case (Friedman 2020). Moreover, it has also been stated that people living in pollution trodden regions

are 15% more likely to be affected by COVID-19 (Friedman 2020). These outcomes can be partly seen as an answer to the conundrum of why some parts of the world have been harder crashed by the COVID-19 crisis compared to others.

Taken together, the aspects discussed here underline that the COVID-19 menace has fractured several crucial sectors of the world at an atrocious extent. Unemployment and starvations have dramatically increased, taking their toll in most parts of the world, so that meeting the country's financial demands remains challenging. The scientific community and health professionals are terribly involved in figuring out a competent therapeutic solution that can effectively face the viral chaos. However, above all, we must also try to admit the factual quote that "Every vileness is followed by happiness and vice versa."

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