Review Article

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UNDERSTANDING AIR POLLUTION INDUCED EPIDEMICS FROM THE VIEW POINT OF INDIAN TRADITIONAL MEDICINE: A REVIEW

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ABSTRACT

Air pollution is one of the major causes of widespread disease manifestation in current era. Surprisingly, a treatise of an Indian Traditional Medicine, i.e. Ayurveda, has mentioned an identical condition centuries ago, under the name of Janapadodhwamsa. Here, Janapada means a locality or area and Uddhwamsa means destruction. Thus, Janapadodhwamsa means an epidemic destruction due to disease or calamity. It is necessary to understand the causes and consequences of Air Pollution from the view point of Ayurveda, in order to add on knowledge about solutions to Air Pollution induced epidemics. For this purpose, the third chapter of the third section (Vimana sthana) of Charaka Samhita, a treatise of Ayurveda, was studied thoroughly with the help of commentary- Ayurveda-dipika to understand the concept in depth. For collecting data regarding Air pollution and its consequences, systematic search was done on the search engine Google, PubMed, AYUSH Portal DHARA and Linked in etc., using relevant key words. Also, various Published power point presentations and online Newspapers were fetched to collect important facts. At the end of all these efforts, great similarity was found in the causes and consequences of Air Pollution and Janapadodhwamsa, which encourages finding out a new solution to Air pollution by rectifying unrighteousness and errors of intellect in human beings.

Keywords: Ayurveda, Charaka Samhita, Error of intellect, Janapadodhwamsa, Unrighteousness, Vimana sthana

INTRODUCTION

Non-communicable diseases (NCDs) account for 70% of air pollution deaths^{1,2}; still Air pollution is a rarely appreciated cause of these diseases. A study published in JAMA³ suggests that long-term exposure to PM 2.5 may lead to plaque deposits in arteries, causing vascular inflammation and hardening of the arteries which can eventually lead to heart attack and stroke. An association between mother's exposure to fine particles and birth defects has also been established by several reports.⁴ Long terms exposure to polluted air may be accounted as a risk factor for neurodevelopmental disorders in children⁵ and neurodegenerative diseases in adults⁶.

According to a major study⁷, one out of every six premature deaths in the world in 2015 - about 9 million - could be attributed to diseases from toxic exposure, while India tops the list of individual countries. Air pollution was responsible for 19% of all cardiovascular deaths, 24% of ischaemic heart disease deaths, 21% of stroke deaths, and 23% of lung cancer deaths, worldwide.⁸ The conservative estimate of pollution-related deaths is one-and-a-half times higher than the number of people killed by smoking and three times the number killed by AIDS, tuberculosis and malaria combined, according to GBD tallies.⁹ Again, Pollution-related disease/ premature deaths and environmental degradation are also responsible for such great economic losses that can distort

health budget and incapacitate the growth prospects of entire countries.⁸

On a shallow thought, it seems that Air pollution is a problem of current era only, but actually the same phenomenon is narrated in an ancient treatise of Ayurveda i.e. in Charaka Samhita.^{10,11} Here, all causative factors of diseases are classified into two groups, viz. (1) those common to living beings in general and (2) those specific to individuals, like constitution and diet. The former type of causative factors commonly affects several living beings of a locality at the same time by vitiating or altering the qualities of the air, water, land and climate. Vitiating of these four factors needs to be focused because it causes cessation in appropriate taste, potency and specific actions of plants and hence is bound to result in the widespread manifestation of diseases and Janapadodhwamsa¹². Here, Janapada means a locality or area and Uddhwamsa means destruction. Thus, Janapadodhwamsa means an epidemic destruction due to disease or natural calamity. Polluted air in today's era and its horrible consequences in form of global warming, land sliding and stronger cyclones are damaging human health and life span similarly as an epidemic.

The third chapter of the third section (Vimana sthana) of Charaka Samhita was studied thoroughly with the help of commentary- Ayurveda-dipika to make the concept crystal clear. For collecting data regarding Air pollution and its consequences, systematic search was done on the search engine Google, PubMed, AYUSH

Portal DHARA and Linked in etc., using relevant key words. Also, various Published power point presentations and Newspapers were fetched to collect important points. Efforts were made to find if any relevant previous research works had been carried out, but no similar studies with identical aims and objectives were observed. The causes and characteristics of vitiated Air, mentioned in the classical text, were compared with that of the Polluted air and logical conclusions were traced out on scientific bases.

DISCUSSION

Amongst the four factors of epidemics, Vitiating of air, water, land and climate are considered to be more dangerous,

respectively. This is due to their indispensability for sustenance of life and easier correction of their vitiation in reverse order¹³. Despite of this, air Pollution is proving fatal to millions of Indians, and the numbers are expected to grow if immediate steps aren't taken.¹⁴

Comparison of Characteristics of Vitiating Vata and Polluted Air

The characteristics of vitiated Vata mentioned in Charaka Samhita can be understood in today's era either as a cause, sign or consequence of air pollution as follows:

Table 1: Identical Characteristics of Vitiating Vata and Polluted Air

S. No.	Characteristic of vitiated Vata as per Charaka Samhita ¹¹	Characteristics of polluted air
1.	Ritu-vishama (Not in accordance of season)	Changed seasonal climate due to Air pollution and its consequences like Global warming.
2.	Ati sthita (Very stagnant air)	Air Stagnation- When an air mass remains over an area for an extended period due to light winds and lack of precipitation, pollutants cannot be cleared from the air, either gaseous (like ozone) or particulate leading to widespread haze. ¹⁵ Decreased wind speed increases air pollution level by reducing frequency distribution of pollutants and aerosol derivatives. ¹⁶ A team led by Daniel Horton, a climate modeller at Stanford University in California, used 15 global climate models to track changes in the number and duration of atmospheric stagnation events. They found that if this stagnant air combines with extreme heat, it becomes the cause of death for a great number of people. ¹⁷
3.	Atichala (High speed wind)	High speed wind causes wind erosions and/or major dust events that can cause environmental impacts at regional and global scales. ¹⁸
4.	Ati abhishyandi (Very moist air)	Increased moisture increases air pollution level by reducing dispersion of pollutants. ¹⁹ Dust concentration increases with relative humidity (reaching a maximum around 25%) and vice versa. ²⁰
5.	Ati Ruksha (Very dry air)	Dry air, having low relative humidity. When the relative humidity drops below about 40%, the air feels dry to skin. If very low relative humidity persists it can make the skin dry, lips chapped and can put more static in the air. In some cases, air will be referred to as dry even when the outside relative humidity is high but the dew point (temperature at which air can hold no more water) is low. This is because even if the air has a high relative humidity of 90% outside, once that air is brought inside and heated the relative humidity will decrease significantly. In situations in which the dew points are low outside (less than around 32 F) that air will often be referred to as dry by weather forecasters especially if the skies are clear. ²¹
6.	Ati Parusha (Extremely dry air)	Extremely dry air, containing least amount of water vapour. ²¹
7.	Ati Sheeta (Very cool air)	Aerosol particles of human origin can have a net effect of diminishing the energy that arrives at the Earth's surface. Scientists estimate that particles produced by human activities have led to a net loss of solar energy (heat) at the ground by as much as 8 percent in densely populated areas over the past few decades. This effect, sometimes referred to as 'solar dimming,' may have masked some of the late 20th century global warming due to heat-trapping gases. ²²
8.	Ati Ushna (Very hot air)	Aerosols, especially black carbon component within Atmospheric brown clouds, generated due to air pollution, absorb solar radiation, and this absorption results in enhanced solar heating of the atmosphere ²³ , causing rapid melting of Himalayan glaciers already being blamed for downstream flooding in late summer. ²⁴ (Picture Shows Big Brown Cloud Storm over Asia –courtesy: Asian Brown cloud Wikipedia)
9.	Ati Rukshoshna/ Ati Abhishyandi-ushna (Very dry and hot/ moist and hot)	Dry tropical (DT) and Moist tropical plus (MT+) weathers result in a fourfold and twofold increased occurrence of an extreme pollution event (top 5 % of pollution concentrations throughout the 28 years). ²⁵
10.	Ati bhairava Ati pratihataparasparagati, Ati kundalinam (Wind with large uproar and extreme speed)	Cyclones Natural differences in wind speed and direction over different heights in the atmosphere, known as 'wind shear', normally keep cyclones in check - effectively tearing the storms apart before they reach a certain size. But emissions from sources such as biomass burning and diesel vehicles have interfered with wind patterns, reducing wind shear and enabling cyclones to grow twice as intense, according to a study published in Nature. ²⁶

		<p>Researchers compared cyclones that occurred between 1979 and 1996 with those between 1997 and 2010. They found that the more recent ones were up to three times more intense, with higher wind speeds — and five of the strongest storms during the period occurred after 1998.</p> <p>A study using combination of observational, reanalysis and model data reports that the anomalous monsoon circulation, which is radiatively forced by anthropogenic aerosols, reduces the basin-wide vertical wind shear, creating an environment more favourable for tropical cyclone intensification. Most Arabian Sea tropical cyclones make landfall, which results in additional impact on human health from regional air pollution.²⁷</p>
11.	Asatmyagandha-bashpa-sikta-panshu-dhumaupahata (air with annoying smell/ vapour/ dust/ smoke)	<p>Air containing gases, dust, smoke from fires or fumes, aerosols²² or fine particulate matter in harmful amounts which may cause 'solar dimming', as mentioned above.</p> <p>Air pollution occurs when the air contains gases, dust, smoke from fires, or fumes in harmful amounts. Tiny atmospheric particles - aerosols - are a subset of air pollution that is suspended in our atmosphere. The composition of atmospheric aerosol particles varies widely depending on their source—they may contain salts (predominantly sulphates), minerals (such as silicon), organic materials, and, in most cases, water.²²</p>

Comparison between the origin and consequences of Vitiated Vata and Polluted Air

Again, resemblance in the origin and results of Air pollution and vitiated Air makes the concept more convincing and authentic. Lord Aatreya has mentioned in treatise that unrighteousness (Adharma) initiated by the error of the intellect (Prajnaparadha) is the root cause of all four types of vitiations. He has set a very practical example of unrighteousness, like - it starts when the authorities of country, society and community break Social, Ethical or Government laws, and don't deal righteously with people. This unrighteousness is further carried forward by their officers, underlings, traders and even laymen. Thus righteousness and righteous people disappear from the place and unrighteousness overrules them. As a result, Gods get annoyed; hence either it does not rain sufficiently in time or there is very heavy rainfall. Even winds, land and water reservoirs get affected and the herbs give up their natural properties. Then epidemics break out due to polluted contacts and edibles.²⁸

The same scenario is observed in today's era. Corruption has reached the heights of sky and immorality has spread up to genes of human beings. Even if one feels the above story is a myth only, then also the unrighteousness and error of intellect can be proved as the causes of Air pollution and its consequences, like:

1. As per the rules of Petroleum and Gas Ministry of India, only a storage licence holder and some selected authorities can deliver or despatch petroleum to anyone in India. But many people tend to purchase low quality petroleum from unauthorized local dealers. Many of Buses and trucks are ridden using Kerosene, which adds much in Air Pollution. Here, Greed and unethicallity are the errors of intellect.
2. People prefer to use personal cars rather than sharing it with others or using Public transport services. If the rides are shared, the total number of vehicles can be reduced to much more extent, and thus pollution can also be reduced. Here, ego, selfishness, no tendency of sharing things and inability of making adjustments are the causative intellectual errors.
3. Even after having LPG facility at home, most of the people in villages tend to use firewood for cooking out of habit. Their ignorance and rigidity are the errors of intellect.
4. Lots of companies and factories don't follow proper SOPs and industrial rules and every day emit tons of toxic gases in air. Here, the trouble is greed of money and unethicallity.
5. Millions Of people worldwide are addicted to smoking, which is harmful in both active and passive ways. Intolerance,

lack of will power and negligence of Social ethics are the errors of their intellect.

6. Deforestation is a major cause of pollution caused by insatiability and self-centeredness of human beings.

Thus, errors of intellect generate unrighteousness which ultimately results into vitiation of body, mind and atmosphere.

Comparison of the effect of Vitiated Vata and Polluted Air on Herbs/ Crops

Drastic changes in seasons and climate have disturbed the life of humans, animals and plants as well. Acharya Charaka has clearly mentioned that herbs lose their natural taste, properties, potency and efficacy due to alteration of the air, water, soil and climate.²⁸ Researches also show that Air pollution may cause leaf damage, slower growth, root damage and inability to photosynthesize properly. Plants may show visible signs of damage like necrotic lesions or changing in colour including chlorosis (aka yellowing leaves), reddening, bronzing or mottling. Ozone holes in the atmosphere also harm plants either by allowing an excess ultraviolet light to pass through the upper atmosphere or by preventing photosynthesis and obstructing stomata in the lower atmosphere.²⁹

One harmful pollutant that too damages plants is acid rain. It is formed when water from the atmosphere is combined with sulphur dioxide and nitrogen oxides suspended in the air³⁰. It damages leaves also and makes it harder for the plant to photosynthesize and regulate the exchange of gases. The acid rain also pollutes the soils and damages plants by dissolving and washing away the nutrients and minerals from the soil on which the plants rely.³⁰

Extreme weather events may cause drastic decrease in genetic diversity. As a result, each individual species become similar to the next one and so the ecosystem cannot develop properly. An absence of genetic mutations and decrease in species richness greatly enhances the possibility of extinction.³¹ Moreover; global warming may affect persistence and survival of plants and their insect herbivores. As these insect herbivores decrease, the levels of species eaten by those insects will increase. This cascading event would be detrimental to whole earth and nature.³¹

Also, the changing Bird migration patterns due to altered seasons could overtime affect the overall ecosystem. When birds leave the place sooner, decrease in the pollination rates of some plants may get started, which would result in plants flowering at different times.

Individual plants and species can successfully complete their life cycles under specific environmental conditions only. Hence, changing environments significantly change life cycle events, which may lead to the asynchrony between species, or to change competition between plants. For example, flowering times in British plants have changed, leading to annual plants flowering earlier than perennials, and insect pollinated plants flowering earlier than wind pollinated plants; with potential ecological consequences as well as human-related problems such as earlier and extended allergy seasons.^{31,32}

In the Proceedings of the National Academy of Sciences, a peer-reviewed US journal³³, it was mentioned that a review study on 70 prior studies on global warming and agriculture reveals that Climate change has a negative effect on key crops. Experts analysed previous research that used a variety of methods, from simulating how crops will react to temperature changes at the global and local scale, to statistical models based on historical weather and yield data, to artificial field warming experiments. All these methods suggested that increasing temperatures are likely to have a negative effect on the global yields of main crops. Each degree Celsius increase in global mean temperature is estimated to reduce average global yields of Wheat by six per cent, Rice yields would be cut by 3.2 per cent and maize by 7.4 per cent.³³

Solution to Air pollution and Vitiatio

The scientists suggest that reduction in number of private vehicles, strict monitoring of SOPs and plantation of trees are the key factors to decrease Air pollution. Again, all this cannot be done up to optimum level unless and until the errors of intellect are not eradicated. The treatise suggests that observance of codes and conducts and following ethics to correct the error of intellect as well as residence in healthy places, fivefold evacuation therapies, ethical and religious living etc. are the modes of management for the protection of life. But these will also work for only those whose death is not predestined during that difficult period³⁴. Shifting to a safe place may not be possible for all. Hence, first of all the errors of intellect should be corrected in order to re-establish righteousness; meanwhile plantation and other efforts must be continued.

CONCLUSION

Air pollution is the burning issue of current era as it is generating cardiovascular diseases, lung cancer and many other fatal/lifelong Non-Communicable Diseases. The classical text of Ayurveda, Charaka Samhita, narrates the same condition under the name of "Vitiated Vata", which causes epidemic diseases and deaths (Janapada-Uddhwamsa). Apart from the known causes of Air pollution, the treatise suggests Unrighteousness, generated because of error of intellect, as the root cause of it. When authorities of nation and society and their subordinates don't follow the codes of righteousness, it ultimately causes vitiatio

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