

Review Article

Impact of environmental toxicity on health in ayurvedic parlance

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ABSTRACT

Environmental toxicity is being increased tremendously and its impact on health is unavoidable. Though many remedial measures are being taken, some serious call for action globally should be taken to make the efforts effective. In Ayurveda significant place has been given for environmental health as its fundamental principle itself relies on the fact that only a healthy environment can help in healthy living of the beings as both are inseparable units co-existing in a complementing manner. The extent of pollution was far less during the period when classical texts of Ayurveda were written, considerable value had given even then for the environmental health. Also, in order to reduce the toxicity of environment and to lighten the burden of ill-effects of environmental toxicity many remedial measures have been advocated. The classical Ayurveda texts and articles available in online databases dealing with the concerned subject were reviewed. The toxicity endorsed by the environmental factors could be prevented to a great extent by resorting to the diet and regimen prescribed by Ayurveda, if symptoms already manifested could be managed by the medications and recommendations given in Ayurveda. Prime focus should be on the status of agni and to restore the metabolism in an optimal level so that the health could be maintained. The preventive as well as curative methods advocated in Ayurveda in limiting the ill-effects of environmental toxicity which has been proven through studies have been discussed here. Transition is nearly inevitable and the necessity to be adapted to the changing environmental conditions is very important. By adopting the daily regimen, seasonal regimen, panchakarma (the five purificatory procedures) and rasayana (rejuvenative) therapy, usage of nitya rasayana (daily admissible revitalizers) along with proper code of conduct (sadvrutta and achara rasayana) will definitely help to reduce the infliction of toxic effects of environmental pollution.

Keywords: Environmental toxicity, Janapadhotwamsa, Air pollution, Land pollution, Water pollution, Seasonal variation, Cumulative toxicity

INTRODUCTION

Environmental toxicity has become a monstrous hazard that even questions the existence of living beings on earth. If this issue is not addressed seriously, and well-sought and highly coordinated remedial measures are not adopted, the entire mankind maybe swamped in the near future. Environmental toxicity results from the bioaccumulation of harmful substances which can be physical, chemical, or biological. The threat of bioaccumulation of hazardous

substances became more pronounced after industrialization and modernization. These environmental hazards have got a serious impact on health of living beings. Though the concern of environmental toxicity was minimal in an earlier era, when we go through the classical texts of Ayurveda, it can be seen that these issues were considered, and adequate importance were given with the thought that only a healthy environment enables to have a healthy life.

METHODS

The classical texts in Ayurveda dealing with the concerned topic has been referred. Articles published in online database have been reviewed for the purpose (Figure 1).

In charaka samhita, the important environmental threats that can possibly happen has been described in the chapter janapadhotwamsa. This chapter deals with the demolitions or mis happenings (udhwamsa) with respect to community

(janapadha). The possible environmental hazards as described in text are vayu (air), udaka (water), desa (land), and kaala (season) which become more dangerous and difficult to manage in the successive order.¹ Basic cause of these environmental hazards is being said as unrighteousness or unjust behaviour which evolves out of ignorance. Due to greediness man makes efforts to make out as much possible from all the available resources around, without considering the ill-effect or fate of the Earth we live, edging his future generations at stake.

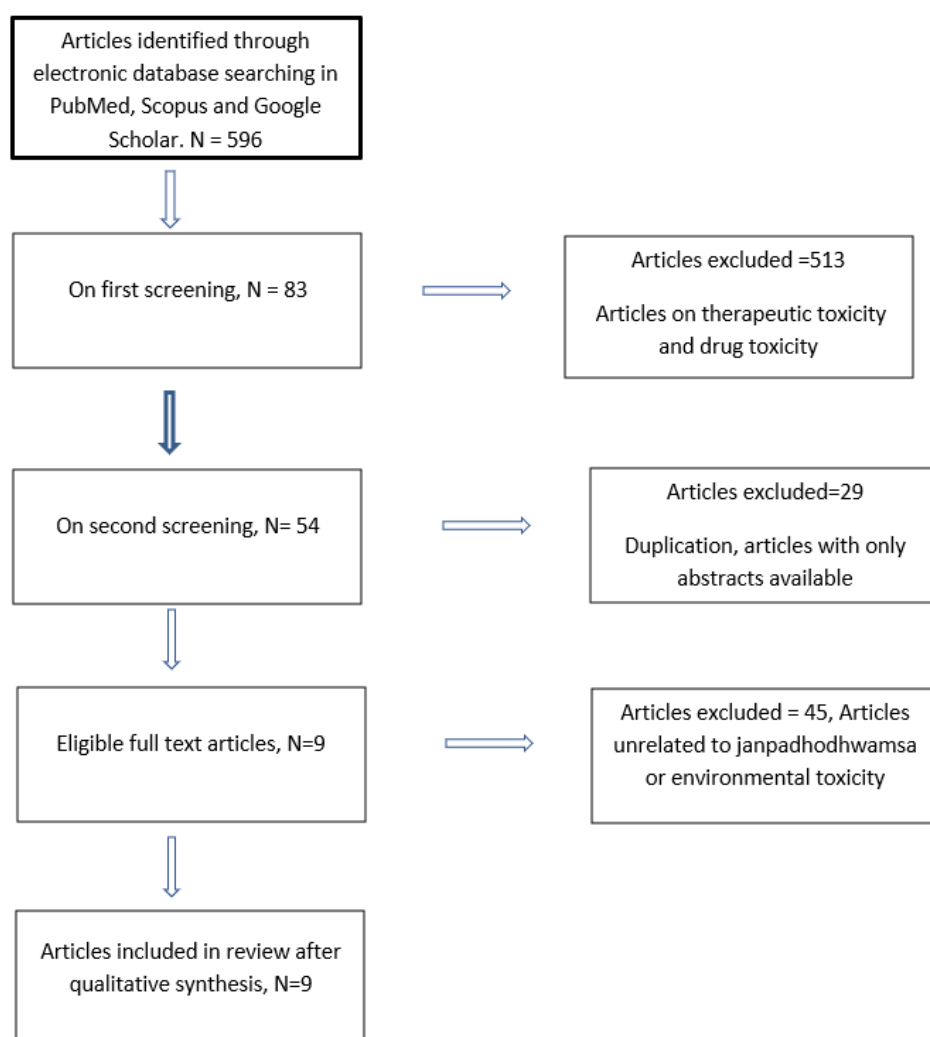


Figure 1: Method of selecting articles for review.

Influence of vayu (air)

The air quality index has become so much affected that about 91% population resides in areas where air quality exceeds World Health Organization (WHO) guidelines.² Every year, around 7 million deaths occur in the world due to air pollution and 1/3rd deaths among them are due to lung cancer, stroke, and heart disease the major sources of air pollution are automobiles, industries, domestic sources, indoor pollutants etc. Urbanization and industrialization have got a significant role in degrading the air quality. The incident of Bhopal gas tragedy in the union carbide India

limited pesticide plant in Madhya Pradesh has shown the ferocious effect of air getting polluted. The different pollutants that affect the air quality are as follows. Hydrocarbons form the major pollutant which causes many serious health issues and even result in lung cancer. Increased quantity of sulphur dioxide can cause respiratory illnesses like asthma, respiratory tract irritation, chronic obstructive pulmonary disease (COPD) and death. The oxides of nitrogen cause respiratory tract irritation, impairs the lung defense mechanisms, and cause bronchial hyperactivity carbon monoxide poisoning can cause cherry lips, asphyxia, unconsciousness, and death. Lead can cause

impaired neuropsychological development. Another major threat of air pollution is the depletion of ozone layer which increases the ultraviolet radiation levels that reach earth's surface and ultimately result in health issues like cough, broncho constriction, skin diseases, and respiratory irritation.³

Prevention of air pollution – modern perspective

As per WHO recommendation, the methods to be adopted to prevent or control the air pollution are: containment – prevention of release of toxic substances to ambient air; replacement – the technological processes causing air pollution like faulty instruments or devices are to be replaced with newer ones, that does not cause the same; dilution – applicable as long as the pollution is within the self-cleaning capacity of environment, like the separation of industrial and residential areas using buffer zones or green belts thereby diluting the impact of polluted air; legislation – through implementation of strict laws, the pollution of air is to be monitored; and international action – establishment of network of laboratories to monitor and study about the air pollution so that measures can be adopted to check air pollution.⁴

Usage of face masks in polluted environment may help to reduce the direct impact on body to an extent.

Ayurvedic view on air pollution

In ayurveda, the signs of vitiated vayu are being mentioned as, those winds which are not following the season, excessively moist, speedy, harsh, cold, hot, rough, blocking, making terrible sounds, excessive clashing with each other, with unsuitable smell, vapours, gravels, dust, and smoke.⁵ Raja dhooma has been mentioned as the causative factor for respiratory illnesses like dyspnoea, cough, and rhinitis.

Signs of vitiated vayu

If the vayu is so much vitiated, flying birds drop down and fall dead. In humans, it causes symptoms like nasal discharge, cough, headache, and eye diseases.⁶

Methods to improve air quality

Several methods to overcome the ill effects of polluted air has been mentioned in Ayurveda of which dhoopana (fumigation) has got an important place. Many drugs have been indicated for fumigation which may have an action on fungal, bacterial and other microbial growth. Some of them are laksha (shellac), haridra (*Curcuma longa* L.), ativisha (*Aconitum heterophyllum* L.), abhaya (*Terminalia chebula* Retz.), musta (*Cyperus rotundus* L.), harenuka (*Vitex negundo* L.), ela (*Elettaria cardamomum* L.), tamalapatra (*Cinnamomum tamala* Buch), kushta (*Saussurea lappa* C.B.Clark), and priyangu (*Callicarpus macrophylla* Vahl).⁷

Recent studies on fumigation indicated in Ayurveda

Aparajitha dhooma choorna is a formulation indicated for purifying the air. It contains ingredients like Vacha (*Acorus calamus*), Mayoorasikha (*Actinopteris dichotoma*), Agar (Aguillaria agallocha), Nimba (*Azadiracta indica*), Arka (*Calotropis gigantea*), Devadaru (*Cedrus deodara*), Guggulu (*Commiphora mukul*) and Saala (*Shorea robusta*). A study on aparajitha dhooma has proven that it has got potential action on microbial growth. Continuous fumigation with aparajitha dhooma choorna for 5 days has shown total inhibition of coliforms and reduced fungal growth.⁸ Another study on fumigation with Vilwa (*Aegle marmelos*) and Devadaru (*Cedrus deodara*) has proven that medicinal smoke reduces airborne bacteria. It showed a 94% reduction in bacterial growth in 60 min upto 24 hours in a closed room.⁹ In a study on agnihotra (fire ritual), which is part of rituals has proven that it is a non-conventional solution to air pollution. Performance of agnihotra with cow's ghee, pipal wood (*Ficus religiosa*), and guggulu (*Commiphora mukul*) has shown 51% reduction in SO₂ and 60% reduction in NO.¹⁰ Non degradable heavy metals like Hg, Cr are yet another potential threat to ecosystem. A study on the leaf extract of tulsi (*Ocimum sanctum*) in allium root meristems has shown effect in modifying the genotoxicity induced by heavy metals. There was significant recovery in the mitotic index and chromosomal aberrations with leaf extract.¹¹ In another study on fumigation with cow dung, cow ghee, cow milk, camphor, guggulu (*Commiphora mukul*), anantamula (*Hemidesmus indicus*), kapurkachri (*Hedychium spicatum*) and sallaki (*Boswellia serrata*) it was found that growth of most aerial microorganisms was inhibited.¹²

Another study on the environmental effect of ornamental and common house plants like tulsi (*Ocimum sanctum*), aloe vera, peace lily, devil's ivy, snake plant, and orchids has shown that CO₂ concentration decreased and O₂ conc. increased in tree cover area.¹³

Influence of JALA (water)

Water covers more than 75% of earth's surface. Retention of the quality of water is highly important for survival as well as socio economic development. Due to contaminated drinking water and poor hygiene about 829 000 people are estimated to die each year from diarrhoea.¹⁴ Diseases caused by water borne vectors like malaria, lymphatic filariasis etc., other environmental disasters like tsunami and floods also account to the fatality due to water resources. The major sources of water pollution are sewage from domestic and industrial purposes, agricultural pollution like pesticides, fertilizers, manures, animal wastes, oil pollution due to spillage, pollution due to radioactive substances, and river dumping.¹⁵

Generally, they can be classified into organic substances like detergents, insecticides, herbicides, inorganic substances like heavy metals, ammonia, nitrates, sulphates,

macroscopic substances like plastic, paper, food waste, thermal pollutants like wastes from atomic, thermal and nuclear power plants.¹⁶

The major problems that arise out of water pollution are vomiting, diarrhea, anemia, loss of appetite, liver and kidney impairment, hepatitis A, hepatitis E, typhoid like fevers, GIT issues, skin disorders, and metal poisoning.

Water purification – modern perspective

Storage of water so that further pollution is prevented, filtration using mechanical or rapid sand filters/biological or slow sand filters, and disinfection using chemical agent are the methods employed to prevent water pollution.¹⁷

Ayurvedic view on water pollution

Water is considered as that which gives life to living beings.¹⁸ Water becomes impure because of decomposed dead bodies of aquatic animals, decomposed unexposed plants, unexposed water to sun, moon, and air, growth of micro-organisms and water when mixed with rainwater. The quality and potency of water should be identified from sight, smell, consistency, odor, taste, chemical transformation.¹⁹

Signs of vitiated water

There will be slimy, strong smelling, frothy appearance with blackish lines on the surface. Aquatic beings die without any apparent cause. Fauna around the polluted water source may seem disoriented. Animals or humans bathing in it will have vomiting, fainting/delusion, fever, burning sensation, swelling of limbs.²⁰ Consuming contaminated water may result in adhmaana (flatulence), udaravyadhi (gastrointestinal disorders), jwara (fever), kasa (cough), kshutmandya (loss of appetite), grandhi (tumors, nodular enlargements, and goitre), angagaurava (heaviness), udarasoola (abdominal pain), koshtabaddhata (constipation), sotha (swelling), pandu (anemia), ajeerna (indigestion), swasa (respiratory distress), pratisyaya (rhinitis), kushta (skin diseases), kandu (itching), and netrabhishyanda (conjunctivitis).

Methods to purify water

Several measures have been mentioned in Ayurveda texts for the purification of water. Putting ashes of the drugs like dhava (*Anogeissus latifolia*), aswakarna (*Dipterocarpus alatus*), patala (*Stereospermum suaveolens*), paribhadra (*Erythrina variegata*), asana (*Pterocarpus marsupium*), nigundi (*Vitex negundo*), mokshaka (*Schrebera swietenoides*), karnikaraka (*Cassia fistula*), and somavalka (*Acacia leucorrhoea*) help to make the water clear and pure.²¹ Impregnation of kataka (*Strychnos potatorum*), gomeda (hessonite), visagranthi (lotus roots), shaivalamoola (root of algae), vastra (cloth), mukta (pearl), mani (potash alum), parnimula (a kind of grass having property of water dilution) and lotus roots; and also

heating, exposing to sunlight, immersing hot iron balls are said to clear water from impurities.²² To remove smell of vitiated water nagakesara (*Messua ferrea* L.), champaka (*Michelia champaka* L.), utpala (*Nymphaea sellata* Willd.), patala (*Stereospermum suaveolens* DC), and karavira (*Nerium indicum* Mill) flowers are indicated.²³ It is advised to store water in gold, silver, copper, earthen vessel or made of bell metal or precious stone.²⁴ Keeping water in copper vessel overnight is said to have certain health benefits like it has got lekhaana property and helps in healing and nourishment. Hamsodaka, the water indicated in sarat rtu prepared by exposing to sunlight and moonlight, has got rasayana (rejuvenating), balya (strengthening), medhya (promotes intellect), tridosahara and anabhishyandi (doesn't obstruct channels of circulation) properties.^{25,26}

Recent studies on water purificatory methods as indicated in Ayurveda

In a study on impact of storing drinking water in copper pots has shown that it kills diarrheagenic bacteria. *E. coli* was completely killed by copper surfaces, none of them was recovered even after enrichment culture.²⁷ Another study on the antibacterial effect of natural herbs in water treatment against total coliform, fecal coliform, *E. coli* by spread plate method, Kirby Bauer disc diffusion method, most probable number method, petrifilm method it was found that among krishna thulsi (*Ocimum sanctum* Linn.), karpooora thulsi (*Ocimum kilimandscharium* Guerke), neem (*Azadirachta indica* A. Juss.) and asoka (*Saraca indica* Linn.), krishna thulsi (*Ocimum sanctum*) has got most efficient antibacterial activity.²⁸ Another study has proven that gomeda has significant effects on water impurities.²⁹ The jalanirvishikarana yoga mentioned by vagbhata was found to have efficient antimicrobial activity and effectiveness for atleast 1 year at room temperature.³⁰ In another study on the effect of *Phyllanthus emblica* in purifying water it was seen that total hardness, pH, magnesium and sulphate levels got reduced. Also, *E. coli*, fecal coliforms, total coliforms got significantly reduced on application of *Phyllanthus emblica* in water.³¹

Influence of desa (land)

Land pollution refers to the deterioration of the earth's land surfaces, at and below ground level.³² The objectionable accumulation of solid and liquid waste introduced in land which maybe physical, biological or chemical results in land pollution. Improper littering, automation, construction, urbanization, non-judicious use of pesticides, deforestation, and illegal/illogical constructions in eco-sensitive zones have caused degradation in the quality of land to a greater extend. The ill effects of land pollution include endangerment and extinction of species, climate change, habitat shifting, wildfires, landslides, polluted land and water sources. It also causes chronic respiratory diseases, skin ailments, increase in incidence of cancers, birth defects, behavioral, endocrine, reproductive and neurological disorders. Accumulation of heavy metals like

cadmium, chromium, lead and arsenic cause serious health issues and can even lead to death.³³

Ayurvedic view on land pollution

Contaminated desa or land could be identified from unusual smell, colour, touch, taste, excessive dampness, abounding in serpents, beasts of prey, mosquitoes, locusts, flies, mice, and owls, abounding in jungles of weeds and grass, abundance of excessively branched creepers, fallen, destroyed or withered crops, smoky wind, unceasing wild cries of birds and baying of dogs, bewilderment and painful disposition of different kinds of birds and animals, constant agitation and overflow of water reservoirs, frequent affliction with thunderbolts, meteorites, and earth quakes, appearance of the atmosphere as if there is confusion, excitement, apprehension and darkness.³⁴ Dwelling in polluted land may cause swelling, burning sensation, falling of hairs and nails.³⁵

Ayurveda remedial measures

Different measures to be adopted to get rid of land pollution include usage of sprinkling agents, and decoction agents. Anantha (*Hemidesmus indicus*), sarva gandha (*Eladi gana*), and sura/black clay in water are indicated as sprinkling agents and vidanga (*Embelia ribes*), paata (*Cissampelos pareira*), and kadabhi (*Albizia procera*) are indicated as decoction agents.³⁶ In order to ensure maximum potency and quality for medicinal drugs, certain conditions have been suggested for the land from which medicinal plants are to be collected. They include drugs are to be collected from sadharana desa (normal land) or jangala desa (dry land), those nourished timely with cold, sunlight (heat), air and water, grown in even, clean land with facilities of water flowing towards south, not collected from graveyard, sacred place, temple, junction, ditch, orchard, anthill or barren land, from land covered with kusa (*Desmotachya bipinnata*), and rohisha (*Cymbopogon martini* Roxb.), having unctuous, black, sweet/golden sweet soil, soft, not ploughed, unaffected by other big trees over-shadowing the medicinal plants.³⁷

Recent studies

In a study on phytoremediation, it was seen that neem (*Azadiracta indica*), wild neem (*Melia azadirach*), and river tamarind subabool (*Leucaena luecocephala*) have shown significant uptake and transport of chromium thereby reducing the burden of chromium in soil.³⁸ In another study on ornamental plants like marigold, chrysanthemum, gladiolus it was found that cadmium removal was maximum with chrysanthemum and gladiolus had highest tolerance for cadmium.³⁹ Chromium has a deleterious effect on tree growth and In yet another study on some multipurpose tree seedlings like *Albezzia amara*, *Casuarina equisetifolia*, *Tectona grandis* and *Leucaena luecocephala*, it was found that there was a pronounced enhancement in chromium uptake by *Albezzia amara* treated with citric acid as soil amendment.⁴⁰

Influence of kaala (season)

Seasonal variations can be either excess or minimal occurrence of regular season, or untimely occurrence of seasons. Climatic variations may occur due to lot many reasons like loss of sea ice or glaciers, accelerated sea level rise, longer and more intense heat waves, extreme weather events, and due to global warming. Vitiation of kaala is the most dangerous as the existence of entire life is dependent on it. The well-being of air, water, food, weather, vegetations, crops, and medicinal plants rely entirely on the normalcy of kaala. In charaka samhita it is said, vitiation of each season may get manifested as in excess, in depletion or in opposite of the characteristic features.⁴¹

The vitiation of all these factors can also result in the outbreak of epidemics. In charaka samhita the causes for spreading contagious diseases have been given as inhabiting together, physical contact, close respiratory contact, having food and sleep together, sharing apparels, ornaments, soaps and other toiletries.⁴² In janapadhotwamsa adhyaya it is said that the unethical practices (adharma) and intellectual blasphemy (prajnaparadha) of individuals and communities may cause environmental hazards, epidemics, and climatic changes which may ultimately affect the nation.⁴³

Management of janapadhotwamsa

The living beings affected by environmental toxicity should be managed by panchakarma therapy including vamana, virechana, astapana vasti, anuvastana vasti, and nasya followed by rasayana (rejuvenative/immunomodulatory) therapies. For this purpose, drugs should be collected from proper place in proper kaala. The individuals should follow proper regimen and lifestyle as advised under sadvrutta (ethical code of conduct) and achara rasayana (moral, ethical and benevolent conduct which can be roughly termed as behavioural tonic). Sadvrutta states that all human activities are meant for the happiness of all living beings; such happiness is based on righteousness/right moral conduct; hence every person should adopt righteousness always.⁴⁴ Intelligent person desirous of well-being should try best to follow the correct regimen of diet, code of conduct and deeds.⁴⁵

Cumulative toxicity

The concept of cumulative toxicity is discussed in ayurveda under dooshivisha. Any type of toxins, even if it is of less potency, when accumulated and retained for longer period will eventually result in some ill effects and is called as dooshivisha.⁴⁶ The management of these accumulated toxins should follow swedana (fomentation), vamana (emesis), virechana (purgation, as per dosha predominance), agadapana (antidotes like dooshivishari agada with honey by acharya vagbhata), raktamoksha (bloodletting), and sudha kalpa mentioned by acharya charaka.^{47,48}

Toxicokinetics and toxicodynamics

From the site of application or exposure the toxins will be absorbed and through the plasma will be distributed into different tissues. There it gets stored, metabolized, undergo biotransformation and the metabolites will be finally eliminated through feces, urine, or bile. The mechanism by which the exposure of cells to these toxins causes cellular or subcellular interaction resulting in early responses and then late responses eventually resulting in pathology comes under toxicodynamics. These cellular effects can be reversible or irreversible depending on the duration of exposure and the toxicodynamic property of the toxicants. Thus, the effect of environmental toxicity can be acute or chronic, local or systemic, immediate or delayed.^{49,50}

DISCUSSION

Ayurvedic management has focus on two things - prevention as well as cure. Ayurveda always advocates the benefits of preventing a cause rather than getting rid of its effect. In order to combat with the diurnal, seasonal variation of dosha ayurveda has recommended observance of daily regimen, seasonal regimen, special attention to overcome the ill effects that may occur at the juncture of seasons (ritusandhi) through recommended panchakarma therapy, modulation of lifestyle according to variation in the status of dosha, practice of yoga and pranayama. Regular practice of yoga has proved to down regulate the pro-inflammatory markers, reduction of interleukin 1-beta, IL-6, and tumor necrosis factor-alpha enhances cell-mediated and mucosal immunity⁵¹, improves antioxidant status and immune functions.^{51,52} The practice of yogic breathing is found to increase elasticity and strength as well as mechanical efficiency of lungs. Regular practice of pranayama helps to downregulate the lipid peroxide production and increases the activity of super oxide dismutase (SOD). It also helps to reduce the free radicals and improve the antioxidant status.⁵³ Another important measure to be adopted so that any derangement of environmental or exogenous causes and also the imbalance of endogenous causes to not afflict our body easily is the rasayana therapy. Rasayana is a way to procure excellence of dhatus like rasa. Longevity, memory, intellect, health, youthfulness, excellence of lustre, complexion, voice, optimal physical as well as sense organs' strength, perfection in deliberation, respectability, brilliance like the benefits of rasayana therapy remains immeasurable.⁵⁴ Regular usage of daily admissible revitalizers like aswagandha (*Withania somnifera*), amalaka (*Emblia officinalis*), triphala (*Terminalia chebula*, *Emblia officinalis* and *T. bellarica*) has proven effects in preventing the affliction of epidemic diseases. Studies have shown that decoction of ashwagandha is indicated in psychiatric diseases and acts as general tonic. Also, it has anthelmintic activity and is useful in blood disorders. It is a proven known drug for its aphrodisiac property. In an experimental study it is proven to be a drug with rejuvenative, anti-stress, neuro-regenerative, anti-tumor and anti-arthritis activity. It promotes the dendrite

formation by its GABA mimetic effect and helps in mitochondrial health.⁵⁵ *Emblia officinalis* has got anti-stress effect against a spectrum of diseases. *Emblia officinalis* could prevent the free radical damage due to stress by strengthening the defence mechanisms through the ability of target tissues to synthesize prostaglandins.⁵⁶ In an animal study, triphala extract has proven to protect the radiation-induced sickness and mortality in mice which may be due to its free radical scavenging and antioxidant activities.⁵⁷ To prevent exogenous diseases the measures to be adopted are avoidance of emotional outbursts (kama, krodha, lobha like dharaneeya vega), control over senses and motor organs, memorizing regimens, proper orientation of place, time, one's own self, following regimen of good conduct, knowledge of prescription of authoritative sages, taking proper decision at right time and when needed. An intelligent person shall follow these measures in advance, even before the occurrence of any ill health.

Curative

The manifestation of symptoms of exposure to environmental toxicity may range from respiratory, integumentary, eye disorders to different carcinoma depending on the extend of exposure. Each condition should be addressed based on the involvement of vitiated dosha, dhatu and srotas (channels) with a special focus on agni. Uction with lavana taila (an oil formulation with rock salt as a major ingredient), fomentation like nadi, prastara, sankara sweda (different types of sudation techniques mentioned), emesis, dhoomapana (inhalation of medicated smoke), and meals which are unctuous including meat soups could be adopted in respiratory conditions. The skin diseases if vata predominant medicated ghee, if pitta predominant virechana, raktamoksha like sodhana procedures and if kapha predominant vamana and repeated sodhana should be adopted depending on the extend of derangement. In case of edema and other associated symptoms, langhana (fasting therapy), pachana (digestives), sodhana (purificatory therapy) like sirovirechana (errhine therapy), vamana (emesis), and virechana (purgation) could be opted. In eye diseases, if acute – sweda (fomentation), pralepa (topical medicaments), tikta anna (foods predominant of bitter taste), dhuma (fumigation), langhana, pachana, seka (eye irrigation with closed eyes), aschyotana (instillation of eye drops), pindi and vidalaka (modified form of topical application over eyelids), theekshna gandoosha (oil pulling with highly potent and sharp drugs); and if chronic, anjana (collyrium), tarpana and putapaka (rehydration treatment methods for eye), could be adopted.

The toxicity endorsed by the environmental factors could be prevented to a great extent by resorting to the diet and regimen prescribed by ayurveda, if symptoms already manifested could be managed by the medications and recommendations given in ayurveda. Prime focus should

be on the status of agni and to restore the metabolism in an optimal level so that the health could be maintained.

CONCLUSION

Transition is nearly inevitable and the necessity to be adapted to the changing environmental conditions is very important. Along with consciousness-raising and call for action at global level, focus on maintenance of health by resorting to healthy diet and regimen along with proper conduct (sadvrutta and achara rasayana) is also imperative. The emphasis should always be on prevention of diseases. Usage of nitya rasayana (daily admissible revitalizers) like aswagandha and amalaki helps to lessen the burden of such exogenous impacts. The potency of ayurveda in detoxifying body as well environment have been proven through several studies. But to explore the hidden treasures in this ocean of knowledge of Ayurveda and to disseminate the scope of Ayurveda in the management of environmental toxicity in living beings, more researches are to be conducted in this regard

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REFERENCES

- Sharma RK, Das VB. Charaka Samhita by Agnivesa, Vimanasthana, Chapter 3: Janapadhodhwamsaneeyam Vimanam, Verse 6, Chaukhambha Sanskrit Series Office, Varanasi, India. 2008;142.
- World Health Organization. Air pollution. Available at <https://www.who.int/airpollution/en/>. Accessed on 09 July 2022.
- Shrikant RI, Yuvraj K, Nagendra S, Kamal C, Kewat M. Scope of Agadtantra (Ayurvedic toxicology) in Environmental Pollution w.s.r to Janpadodhvana & Dushi visha: A Review. Arch Pharma Pract. 2019;10(2):81-8.
- Park K. Park's textbook of Preventive and Social Medicine, Chapter 15, M/s Banarasi Bhanot Publishers, India. 26th edition. 2021;832.
- Sharma RK, Das VB. Charaka Samhita by Agnivesa, Vimanasthana, Chapter 3: Janapadhodhwamsaneeyam Vimanam, Verse (1)6, Chaukhambha Sanskrit Series Office, Varanasi, India, Reprint. 2008;142.
- Acharya VJT. Susruta, Sushruta Samhita, Kalpasthana, Chapter 3 Jangamavishakalpa Vijnaneeya, Verse 16 Chaukhambha Sanskrit Samsthan, Varanasi, India. 2014;568.
- Acharya VJT. Susruta, Sushruta Samhita, Kalpasthana, Chapter 3, Verse 17, Chaukhambha Sanskrit Samsthan, Varanasi, India. 2014;569.
- Celine C, Sindhu A, Muraleedharn MP. Microbial growth inhibition by aparajitha dhooma choornam. Anc Sci Life. 2007;26(3):4-8.
- Nautiyal CS, Chauhan PS, Nene YL. Medicinal smoke reduces airborne bacteria. J Ethnopharmacol. 2007;114(3):446-51.
- Sharma PK, Ayub S, Tripathi CN, Dubey SK. Agnihotra – a non-conventional solution to air pollution. Int J Innovative Res Sci Amp Eng. 2014;2.
- Babu K, Maheswari U. In vivo studies on the effect of Ocimum sanctum L., leaf extract in modifying the genotoxicity induced by chromium and mercury in Allium root meristems. J Env Biol. 2006;27(1):93-5.
- Lad N, Palekar S. Preparation and evaluation of herbal dhoop for cleansing the air. Int J Herbal Med. 2016;4(6):98-103.
- Kulkarni KA, Zambare MS. Impact of house plant in the purification of environment using wireless sensor network. Scientific Res Open Access. 2018;10(3):59-69.
- World Health Organization. Drinking-water. Available at: <https://www.who.int/news-room/fact-sheets/detail/drinking-water>. Accessed on 15 July 2022.
- Law and your Environment. Water pollution. Available at: <http://www.environmentlaw.org.uk/rte.asp?id=90>. Accessed on 15 July 2022.
- World Health Organization. Water pollution. Available at: <https://www.who.int/waterpollution/en/>. Accessed on 15 July 2022.
- Park K. Park's textbook of Preventive and Social Medicine, Chapter 15, M/s Banarasi Bhanot Publishers, India, 26th edition. 2021;805.
- Mitra J. Ashtanga Sangraha Sootrasthana by Vagbhata, Chapter 6 Dravadravya Vijnaneeya Adhyaya, verse 11 Chaukhambha Sanskrit Series Office, Varanasi, India, 3rd Edition. 2006;37.
- Acharya VJT. Charaka Samhita by Agnivesa, Vimanasthana Chapter 3 Janapadhodhwamsaneeyam Vimanam, Verse (2) 6, Chaukhambha Prakashan, Varanasi, India. 2007;241.
- Acharya VJT. Susruta, Sushruta Samhita, Kalpasthana, Chapter 3: Jangamavishakalpa Vijnaneeya, Verse 7-8 Chaukhambha Sanskrit Samsthan, Varanasi, India. 2014;567-8.
- Acharya VJT. Susruta, Sushruta Samhita, Kalpasthana, Chapter 3: Jangamavishakalpa Vijnaneeya, Verse 9 Chaukhambha Sanskrit Samsthan, Varanasi, India. 2014;568.
- Acharya VJT. Susruta, Sushruta Samhita, Sootrasthana, Chapter 45: Dravadravyavidhim Adhyaya Verse 17-19 Chaukhambha Sanskrit Samsthan, Varanasi, India. 2014;198.
- Murthy KRS. Sushruta Samhita, Chaukhambha orientalia, Varanasi, India, Sutrasthana. Chapter 45: Dravadravyadi adhyaya upakrama, verse. 12. 2010;326-8.
- Acharya VJT. Susruta, Sushruta Samhita, Sootrasthana, Chapter 45: Dravadravyavidhim Adhyaya Verse 13 Chaukhambha Sanskrit Samsthan, Varanasi, India. 2014;198.
- Kunte AM. Ashtanga Hrudaya by Vagbhata, Sootrasthana Chapter 3 Rithcharya adhyaya, Verse 51-

- 52, Chaukhambha Sanskrit Samsthan, Varanasi, India. 2014;49.
26. Acharya VJT. Susruta, Sushruta Samhita, Sootrasthana, Chapter 45: Dravadravyavidhim Adhyaya Verse 25 Chaukhambha Sanskrit Samsthan, Varanasi, India. 2014;199.
27. Sudha VB, Ganesan S, Pazhani GP, Ramamurthy T, Nair GB, Venkatasubramanian P. Storing drinking-water in copper pots kills contaminating diarrhoeagenic bacteria. *J Health Popul Nutr*. 2012;30(1):17-21.
28. Harikumar PS, Manjusha CM. Study on the Antibacterial activity of selected Natural Herbs and its application in Water Treatment. *Drinking water Engineering and Science Discussions*. 2013;6:199-231.
29. Pal AA, Shrikantha PH, Chandra N, Rao P. Experimental study of Shushrutokta Jalaprasadana vidhi WSR to Gomeda. *J Ayurveda Amp; Holistic Med*. 2015;3(4):42-52.
30. Kalasannavar SB, Hiremath SK, Hampannavar US. An experimental study on the efficacy of Vangbhatokta Jala Nirvishikarana Yoga on polluted water. *Int J Ayurveda Pharm Res*. 2018;6(12):26-33.
31. Satish, Pandian S, Amuthan A. Effect of soaking of Phyllanthus emblica wood in drinking - water for purification. *Int J Pharmacol Clin Sci*. 2012;1(1):19-23.
32. Texas Disposal System. Land pollution. Available at: <https://www.texasdisposal.com/blog/landpollution/>. Accessed on 25 June 2022.
33. Sciencing. How Land Pollution Affects Humanity. Available at: <https://sciencing.com/land-pollution-affects-humanity-23254.html>. Accessed on 25 June 2022.
34. Acharya VJT. Charaka Samhita by Agnivesa, Vimanasthana Chapter 3 Janapadhodhwamsaneeyam Vimanam, Verse (3) 6, Chaukhambha Prakashan, Varanasi, India. 2007;241.
35. Acharya VJT. Susruta, Sushruta Samhita, Kalpasthana, Chapter 3: Jangamavishakalpa Vijnaneeya, Verse 10-11, Chaukhambha Sanskrit Samsthan, Varanasi, India. 2014;568.
36. Acharya VJT. Susruta, Sushruta Samhita, Kalpasthana, Chapter 3: Jangamavishakalpa Vijnaneeya, Verse 12, Chaukhambha Sanskrit Samsthan, Varanasi, India. 2014;568.
37. Acharya VJT. Charaka Samhita by Agnivesa, Kalpasthana Chapter 1 Madanakalpa Adhyaya, Verse 9, Chaukhambha Prakashan, Varanasi, India. 2007;653.
38. Saktivel V, Vivekanandan M. Springer Reclamation of tannery polluted soil for phytoremediation. *Physio Mol Biol Plants*. 2009;15(2):175-80.
39. Khajanchi L, Minhas PS, Shipra, Chaturvedi RK, Yadav RK. Extraction of cadmium and tolerance of 3 annual cut flowers on Cd contaminated flowers, *Science Direct (Bioresource Technology)*. 2008;99:1006-11.
40. Shanker AK, Ravichandran V, Pathmanabhan G. Phytoaccumulation of Cr by some multipurpose tree seedlings, Springer, Agroforestry systems. 2005;64:83-7.
41. Acharya VJT. Charaka Samhita by Agnivesa, Vimanasthana Chapter 3 Janapadhodhwamsaneeyam Vimanam, Verse (4) 6, Chaukhambha Prakashan, Varanasi, India. 2007;241.
42. Acharya VJT. Susruta, Sushruta Samhita, Nidanasthana, Chapter 5: Kushta Nidana adhyaya, Verse 33-34, Chaukhambha Sanskrit Samsthan, Varanasi, India. 2014;289.
43. Acharya VJT. Charaka Samhita by Agnivesa, Vimanasthana Chapter 3 Janapadhodhwamsaneeyam Vimanam, Verse 20, Chaukhambha Prakashan, Varanasi, India. 2007;242.
44. Kunte AM. Ashtanga Hrudaya by Vagbhata, Sootrasthana Chapter 2 Dinacharya adhyaya, Verse 20, Chaukhambha Sanskrit Samsthan, Varanasi, India. 2014;29.
45. Acharya VJT. Charaka Samhita by Agnivesa, Sootrasthana Chapter 7: Na vegan dharaneeya adhyaya, Verse 56-59, Chaukhambha Prakashan, Varanasi, India. 2007;54.
46. Acharya VJT. Susruta, Sushruta Samhita, Kalpasthana, Chapter 2: Sthavaravisha Vijnaneeya Adhyaya, Verse 25-26, Chaukhambha Sanskrit Samsthan, Varanasi, India. 2014;564.
47. Kunte AM. Ashtanga Hrudaya by Vagbhata, Utharasthana Chapter 45 Vishapratishedha adhyaya, Verse 38-39, Chaukhambha Sanskrit Samsthan, Varanasi, India. 2014;905.
48. Acharya VJT. Charaka Samhita by Agnivesa, Kalpasthana Chapter 10 Sudhakalpa Adhyaya, Verse 5-6, Chaukhambha Prakashan, Varanasi, India. 2007;668.
49. Merwe DV, Buur JL. Toxicokinetics. *Veterinary Toxicology (Second Edition)*. 2012.
50. Toxicodynamics. Available at: <https://en.m.wikipedia.org/wiki/Toxicodynamics>. Accessed on 04 June 2022.
51. Falkenberg RI, Eising C, Peters ML. Yoga and immune system functioning: a systematic review of randomized controlled trials. *J Behav Med*. 2018;4(4):467-82.
52. Manna I. Effects of Yoga Training on Body Composition and Oxidant-Antioxidant status among Healthy Male. *Int J Yoga*. 2018;11(2):105-10.
53. Bhattacharya S, Pandey US, Verma NS. Improvement in oxidative status with yogic breathing in young healthy males. *Indian J Physiol Pharmacol*. 2002;46(3):349-54.
54. Acharya VJT. Charaka Samhita by Agnivesa, Chikitsasthana Chapter 1 Rasayana Adhyaya, Pada 1, Verse 7-8, Chaukhambha Prakashan, Varanasi, India. 2007;377.
55. Singh N, Bhalla M, de Jager P, Gilca M. An overview on ashwagandha: a Rasayana (rejuvenator) of Ayurveda. *Afr J Tradit Complement Altern Med*. 2011;8(5):208-13.

56. Rege NN, Thatte UM, Dahanukar SA. Adaptogenic Properties of Six Rasayana Herbs Used in Ayurvedic Medicine. *Phytotherapy Research* *Phytother Res*. 1999;13:275-91.
57. Jagetia GC, Malagi KJ, Baliga MS, Venkatesh P, Veruva RR. Triphala, an ayurvedic rasayana drug, protects mice against radiation-induced lethality by free-radical scavenging. *J Altern Complement Med*. 2004;10(6):971-8.

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