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Arsenic Toxicity: Its Existence, Permeability and Ill Effects on Human Health – A Mini Overview

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ABSTRACT

Arsenic has an awful influence on millions to billions of people throughout the world, with a special emphasize on the population of economically developing countries like India because of its poisonous nature, which leaves destructive to deadly health effects on human beings. Mobilization of this metalloid contaminant is possible from both natural and anthropogenic sources following various processes. Absorption of arsenic in the human body occurs either through inhalation of air coming out of various wastes of industry, soil, fossil fuels etc., or ingestion of contaminated food, and most importantly, via drinking water having a higher arsenic concentration. Long back, almost a century ago, arsenic was used as a homicidal agent. Exertion of such a toxicant is also possible through its vast agricultural use as a pesticide and its use as a chelating therapeutic agent used to save human lives from arsenic spreading in different body parts. The toxic nature of inorganic trivalent arsenic is much more dominant over pentavalent as well as its organic species. Its adverse health effects on humans are visibly of two types: acute and chronic. Depending upon the nature of exposure and absorption of such a lethal dose in the human body, it causes several disorders, including gastrointestinal, skin, pulmonary, cardiovascular, hepatic, neurobehavioral, diabetic, reproductive etc. along with carcinogenicity of the lung, bladder, skin, kidney, etc. Preventive measures are necessary by enhancing the awareness of poor people about the cruel destiny of arsenic intake, providing ample drinking water free from arsenic in the affected areas, and developing initiative by identifying the affected sources of various government and non-government funding agencies. In this article, an attempt has been made to provide an overview of the health impacts caused by arsenic poisoning.

***Keywords*:** *Arsenic Toxicity*; *Drinking Water*; *India*; *Human Health*; *Prevention*

Introduction

Among the metals causing toxicity, arsenic is one of the most important contaminants, leading to extensive endemicity throughout the sphere. The toxic effects of arsenic on human health have now become a worldwide problem due to their severity. Intake of arsenic at elevated level has lots of fatalistic effects on the human body. In the early eighteenth century, arsenic became renowned for its inherent poisonous nature because its sharp potential as a homicidal agent resulted in the recurrent murders of well reputed persons. Arsenic, for having such efficacy in killing people, attained fame as the 'king of poisons' and the 'poison of kings' (Hughes *et al*., 2011). The path of insertion, duration of

exposure to toxic arsenic and its existence in different chemical forms determine the amount of arsenic absorbed in the body.

The naturally existent virulent arsenic metalloid is omnipresent in the environment. It is found to be present in rocks, rock forming minerals, soils, sediments, organisms, surface and ground water in an appreciable amount (Shankar, Shankar & Shikha, 2014). Rock erosion, volcanic eruptions, dust storms, weathering reactions, and forest fires are some of the naturally mobilizing activities of poisonous arsenic (Herath *et al*., 2016). In addition to these natural methodologies, several anthropogenic activities also need to be mentioned as sources of arsenic spreading among humans. Metal mining, burning of coals, smelting, agronomy, use of fossil fuels, manufacture of paper, cement industry, and wood preservatives are the significant anthropogenic origins of arsenic (Chung, Yu & Hong, 2014). The responsibility of individual agricultural industries in the disbursal of vast amounts of arsenic into the environment is worthy of mention. A large amount of arsenic is released during pesticide production in the forms of arsenic acid, dimethylarsenic acid, mono- and di-sodium methyl arsenate etc. Again, utilization of arsanilic acid as an additive to animal feed transmits the threatening toxicity of arsenic (Hughes *et al*., 2011).

There can be several ways of arsenic insertion in human body *via* consumption of food, fossil fuel, drinking water, inhalation, contact through the skin etc., of which drinking water is the most dangerous medium. The route of exertion of noxious arsenic in the human body is highly complicated and does not follow any conventionally accurate technique. It is still not enlightened, evidently, even after going through a long journey of research work. Alarming levels of arsenic are observed to be released mainly from water, either by direct intake or through its usage in cooked things. People procure drinking water from variable sources in nearby localities like wells, reservoirs, rivers, lakes, etc. To date, especially in developing countries like India and others, groundwater is considered to be the main source for drinking purposes. Incidentally, the extent of contamination with deadly arsenic happens to be the maximum in groundwater. In groundwater, elevated arsenic concentrations impose public health threat, mostly to the severely affected millions of people in India and Bangladesh, as they are directly exposed to varying levels of impermissible toxicity (Chowdhury *et al*., 2000). The aquifers of the alluvial Ganges adapted as the source of drinking water supply for the Bengal basin, are immensely polluted with poisonous arsenic. The Bengal belt is one of the most hampered parts by arsenic toxicity because of its rise in concentration in groundwater (Das *et al*., 2009).

Deadly arsenic develops in groundwater pollution from the very well-known natural sources of minerals like arsenic-containing sulfides (red realgar and yellow-orange orpiment), pyrites and iron oxy-hydroxides having arsenic. The mobilization of toxicity arising from arsenic release in groundwater results mainly from arsenic-sulfide oxidation, microbial metabolism, desorption and reductive dissolution of arsenic from its hydroxides, oxides and iron-oxides (Welch *et al*. 2000).

Prolonged swallowing of arsenic by humans in excess amounts causes a large number of diseases, like multiorgan failure, and even a number of deadly health disorders. A rise in the

intake of arsenic through drinking water shows dermatological disorders, melanosis, gastric problems, pancreatic insufficiency, bowel irritation, symptoms like paralysis, diseases related to cardiology, neuropathy, behavioral abnormalities, vascular anomalies, reproductive system, portal fibrosis, hyperkinesias, renal disease, and diabetes (Mandal & Suzuki, 2002). Several carcinogenic syndromes are also caused by toxic arsenic consumption, which results in skin, lung, kidney, liver, and urinary bladder cancer (Mazumder & Dasgupta, 2011). It shows its outcome even in stillbirths, human infant deaths etc. In this article, the main focus is on the relentless dermatological, non-carcinogenic, and carcinogenic effects caused by mankind's chronic arsenic ingestion.

Literature Review

Chemical Existence of Toxic Arsenic

In conjunction with other elements of the nitrogen group *i.e.*, group 15, arsenic is a fearsome toxic element present in the fourth period of the modern periodic table with its atomic weight of 74.92 and 33 atomic number. This harmful element has an elaborate history of creating vulnerability in human health. This element has neither odor nor taste, so its detection in people becomes very troublesome (Hughes *et al*., 2011). But its poisoning effects leave visible ailments in the human anatomy. This environmentally potent toxicant is basically a metalloid with the dual characteristics of both a metal and a non-metal. It shows the lustrous nature of metal, its ductility and malleability, and its heat and electricity conduction properties, along with the non-ignorant part of having the non-ductility nature of it in its elemental form. Depending on the variability of the existence of different oxidation states, arsenic shows its diversity in the toxicity level. Arsenic can exist naturally in the span of –III, 0, +III and +V oxidation states, of which the most commonly persistent are the +III and +V ones and the more rare are the 0 (elemental) and –III (arsine and arsenide) states. In groundwater, the regularly known chemical forms of arsenic are arsenites and arsenates with their +III and +V valence states, respectively, as inorganic species, which undergo inter-conversion by redox methodology. Organic forms of arsenic derived from the inorganic ones by the method of bio-methylation also exist in nature. In addition to the inorganic forms, organic methylated arsenicals are also found in groundwater in very small amounts. The public is mostly exposed to these two valence states of arsenic (Flora, 2015). Mankind is affected mostly by the consumption of trivalent and pentavalent arsenic compounds, as they are absorbed to a greater extent by human organs. Some well known arsenic compounds with +3 and +5 oxidation states are arsenite(+III) and arsenate(+V), arsenic trioxide(+III) and pentoxide(+V), monomethyl arsonous(+III) and arsenic acid(+V), dimethyl arsinous(+III) and arsenic acid(+V), trimethyl arsine oxide(+V), arsanilic acid(+V), arsenobetaine(+V) *etc*. (Sturgeon *et al*., 1989) In comparison to organic arsenic compounds, the abundance of inorganic arsenic compounds in the environment is much higher. Considering the order of toxicity, it has been noticed that the As(III) is about sixty times more toxic than the As(V), and in the case of methylated arsenic, *i.e.*, the organic one, it is less toxic by almost a hundred times than the inorganic arsenic compounds (Hughes *et al*., 2011).

Permeability Level of Arsenic in Human Body

A huge entity of people globally, exceeding 100 million, and especially a community also in millions of poor developing countries like India are at risk of considerable elevated levels of deadly arsenic exposure, of which maximal absorption occurs through drinking water (Ravenscroft, Brammer & Richards, 2009). Populations higher than two billion are dependent on groundwater as the dominant source of drinking water and this has become a universal challenge to provide drinking water free from toxic metal contamination with such rapid population growth. In accordance with the 1993 World Health Organization (WHO) guidelines and also the US Environment Protection Agency (EPA, 2001), the permissible level of arsenic in the human body has been reduced from 50 ppb to 10 ppb to diminish the carcinogenic hazard to mankind. However, in more than 100 countries, inclusive of the USA, Africa, Argentina, Australia, Bangladesh, Burma, Cambodia, Chile, China, Hungary, India, Mexico, Myanmar, Nepal, Pakistan, Peru, Sri Lanka, Thailand and Vietnam (Shaji *et al*., 2021), in underground water arsenic concentration has been detected in more than the prescribed level by WHO. Taking into account the severity of exposure to the arsenic toxicity of an economically developing nation like India, it has been found that in addition to the four Union Territories, almost twenty states of India, among which Himachal Pradesh, Haryana, Punjab, Arunachal Pradesh, Assam, Bihar, Jharkhand, West Bengal, Chhattisgarh, Odisha, Andhra Pradesh etc. have been affected by the harshness of arsenic contamination in groundwater to a greater extent (Shaji *et al*., 2021). In current times, in countries like India, a huge mass are not at all very mindful of the cruel fate of humankind caused by drinking arsenic contaminated groundwater. In India, it has been well documented that the extent of poisonous arsenic was found is much higher in shallow aquifers than in aquifers more than 100 m deeper (Shaji *et al*., 2021). In 1980, in the eight districts of West Bengal, India, the existence of arsenic was first proclaimed at a very high level (Das, 2019). On both banks of the Bhagirathi River, the districts of Bengal (Howrah, Hooghly, Bardhaman, Malda, Murshidabad, Nadia, 24-parganas) are found to be the most affected by arsenic occurrence in groundwater. The concentration of such a toxicant as arsenic was found to be abnormally high, even greater than 300 ppb in some of the aquifers, which can create disaster and lead to a death toll. This endorsed guideline of the recommended level of arsenic in humans cannot be maintained in various countries, this standard value can only be followed to some extent in well-off countries. In Germany, since 1996, after a series of arguments, they have decided to accept the allowed limit of ingestion of arsenic in people to be 10 ppb as standard, whereas in Australia it has a limit of up to 7 ppb, and in Canada they have considered the permissible limit to be up to 25 ppb (Ravenscroft, Brammer & Richards, 2009). Countries suffering from economic obstacles fail to implement such a level of arsenic absorption because of the unease of immoderate expenditure. It is worthy of mention that 10 ppb is not even the safest guideline for living a healthier life; in the real world, it should have been 0.17 ppb. But failure in the instrumental measurement accuracy for arsenic speciation results in the compromise of such a recommended level (World Health Organization, 1993).

Consequences of Toxic Arsenic on Human Health

In ancient ages and also in modern ages, the characteristics of the insidious arsenic virulence resulting in mortality have remained changeless. The untold suffering of a huge population of millions living in poverty and facing starvation, specifically in the Bengal basin, including India and Bangladesh, is horrendous due to their continuous exposure to arsenic toxicity essentially through drinking water directly or indirectly above its admissible level for survival. Arsenic poisoning in the human body can occur in acute and chronic manners. Acute poisoning by arsenic develops mostly by unintended intake or very rarely by ingestion out of depression with a desire for own destructiveness at an abnormally high concentration (Ravenscroft, Brammer & Richards, 2009). Acute toxicity caused by arsenic absorption in the human body normally shows its harshness in a very short time, sometimes within an hour. Acute arsenic maladies involve impairment of cardiological organs, imbalance of the nervous system, which follow the pathway of fatality in a short duration. Another major dilemma as a symptom of acute arsenic poisoning happens to the gastrological organs of the human body, involving a vicious vomiting tendency, unbearable abdominal pain, diarrhea, nausea, and uncontrollable salivation. It also causes muscular aches, skin disorders, and multi-organ breakdown. In acute syndrome, variability in the amount of consumption of arsenic and its absorption in the human body leads to the loss of life within a time range of one to four days (Ratnaike, 2003).

In accordance with WHO, chronic arsenic syndrome is the outcome of arsenic intake much above the safe level for a long duration, perhaps more than six months. Health complications arising out of chronic arsenic toxicity sometimes remain asymptomatic for even more than ten years. This toxicity has a number of severe human health complications, including disorders in the immune system, bronchitis, hematological imbalance, liver cirrhosis, peripheral neuropathy, non- functional renal system, cardiological failures, dermatological complexity and diabetes mellitus (Ratnaike, 2003). Also, chronic arsenic consumption through drinking water causes detrimental reproductive irregularities, resulting in premature birth, stillbirth, instinctive abortion, retardation in child growth and infections at the infant stage. (Hopenhayn-Rich *et al*., 2000). Chronic arsenic exposure to an extremity increases the probability of malignancy in different body parts of a human being. In 1980, arsenic was perceived as a carcinogenic element and received registration from the International Agency for Research on Cancer (IARC, 2012). Exhaustion of arsenic in chronic fashion leads to the malignancy of different organs of the human body, like the skin, lung, liver, kidney, urinary bladder and colon. The aftereffects of carcinogenic behavior in humans as a result of prolonged arsenic exposure in the initial stages of life last for decades until old age (Ratnaike, 2003).

Effects on Skin

Considering the skin to be the major part of the body, chronic arsenic exposure to it shows a number of dermatological abnormalities, especially in the undernourished people of economically developing countries. In 1983, skin lesions caused by arsenic consumption were first determined in India at the School of Tropical Medicine in the Dermatology

Department, Kolkata (Saha, 1995). Hyperkeratosis, keratosis and pigmentation are the most common forms of skin lesions arising from chronic arsenic poisoning. Keratosis is associated with the development of uniform or sometimes diffused nodular elevations on the upper part of the skin, including the palms and soles, resulting in its thickening. With discrepancies in the level of penetration of the toxic arsenic inside the skin depending upon the extent of exposure, arsenical keratosis can be of various types. When its outcome is seen on both the palms and soles after a decade of chronic exposure, the dryness and thickening of the skin are referred to as diffused keratosis, sometimes leading to severe keratosis. When its visibility is on the soles of the feet or only on the dorsal part of the palms, soles, and legs with sensible nodules, those are referred to as partial and dorsal keratosis, respectively (Ravenscroft, Brammer & Richards, 2009). Another variety is the spotted keratosis, with a greater number of enlarged, rough, dry, nodular appearances. Hyperkeratosis shows symptomatic skin thickening with visible cracks and fissures (Saha *et al*., 1999). Hyperpigmentation emerging out of long-term chronic arsenic exposure appears as dispersed dark brown spots, skin darkening in a diffused manner noticeably on limbs and trunks, along with peculiar appearances of colorless spots following somewhat like a raindrop pattern (Ratnaike, 2003). The rise in exposure to ultraviolet radiation and the presence of a greater quantity of melanin in the skin raise the probability of comparatively rare Bowen's disease, mostly in people of Asian countries. In de-pigmented skin, *i.e*., in the absence of melanin, dermal arsenic absorption accelerates the tendency for squamous and basal cell carcinoma (Ratnaike, 2003). Another symptomatic malady termed "Mee's line due to the accumulation of toxic arsenic in the keratin-enriched part of the human body arising from its chronic ingestion shows marked white lines appearing crosswise in the finger and toe nails (Ratnaike, 2003). A reported observation of the gender-based effect of arsenic contamination presents a slight predominance of skin lesions in males over females (Rahman *et al.*, 2006).

Effects on Neurological System

Arsenic absorption in different parts of the body for a lengthy period can affect the brain markedly because of its wide range of toxicity. Its effect appears to be a distraction of the concentration of the mind and learning abilities of the affected person, as it can efficiently penetrate the blood-brain barrier (Mundey *et al.*, 2013). Intake of arsenic and its agglomeration for a prolonged period of time from early childhood can show several neurobehavioral changes upon reaching the early adulthood stage (Tsai *et al.*, 2003). The maximum deposition of toxic arsenic in the brain occurs in the pituitary gland. Chronic inhalation of more poisonous inorganic arsenic can develop complications related to sensory and symmetrical sensorimotor neuropathy, which affects the muscles and sensations (Guha Mazumder, 2003). Numbness, muscle weakness, loss of reflexes, pain in the soles of the feet and a feeling of paraesthesia are some of the common symptoms caused by neuropathy (Vahidnia *et al.*, 2007). Arsenic consumption above its recommended level by WHO can also cause central and peripheral neuropathies, of which peripheral neuropathy is the prevalent one affecting the peripheral nerves (Mathew, Vale & Adcock,

2010). Extensive study on this reveals that the symptoms arising from peripheral neuropathy have very much in common with Guillain–Barré syndrome, which has its own calamitous consequence of showing little weakness and sometimes resulting in terrible paralysis. In West Bengal, India, a detailed survey reported that severe complications caused by peripheral neuropathy emerge mainly from chronic arsenic ingestion through drinking contaminated groundwater (Mukherjee *et al.*, 2003).

Effects on Respiratory System

Chronic inorganic arsenic ingestion in elevated concentrations through drinking water or through the exhaustion of dust and fumes in the industrial area is a worthy factor in growing respiratory complexities, causing malfunctionality of the lungs and leading to fatalities. A longitudinal study related to respiratory troubles due to arsenic absorption reveals some prevalent clinical symptoms like trachea and asthmatic bronchitis, laryngitis, chronic cough, wheezing chest sounds, breath shortness and rhinitis (Guha Mazumder *et al*., 2000). A long-term research report admits that numerous people from the Bengal basin with harsh skin lesions arising from arsenic intake at elevated levels suffer from adverse pulmonary diseases (Guha Mazumder, 2007). Chronic obstructive pulmonary disease (COPD) is a very well-known respiratory illness that has an acceptable connection with chronic arsenic toxicity. Arsenic intake unconsciously from very early childhood can enhance the chances of bronchiectasis (Guha Mazumder *et al*., 2005).

Effects on Cardiovascular System

Chronic penetration of poisonous inorganic arsenic in its trioxide form rapidly enhances the probability of human expiration, arising from the impairment of the cardiovascular system and disrupting the normal flow of the blood vessels. An enhancement in the accumulation of platelets in the human body due to prolonged arsenic intake also hampers normal cardiological activities (Lee *et al.*, 2002). Thickening and stiffening of arteries, myocardial infarction and ischemic heart diseases disrupting the blood flow to the heart muscle are also caused by the severity of arsenic consumption. Another endemic cardiovascular disease is Blackfoot disease, which results in foot gangrene, and this is mainly confined to the coast of the western part of Taiwan (Rahman *et al.*, 1999).

Effects on Renal System

Kidney irregularities, as a virulent outcome of chronic arsenic absorption in the human body, have now been gradually increasing in the present days. Arsenic intake as a result of long term exposure to it causes its simultaneous liberation through renal functioning along with its aggregation in the kidneys, damaging the renal tissues (Madden & Fowler, 2000). In kidneys as well, the conversion of less toxic pentavalent arsenic to more toxic, sparingly soluble trivalent arsenic takes place. Hypourea, urea nitrogen level in blood, proteinurea and rise in the level of serum creatinine are some of the kinds of renal injuries caused by the poisonous nature of arsenic trioxide intake in various ways (Sasaki, Oshima & Fujimura, 2007). Deposition of arsenic in the renal organs to a greater extent also causes destruction of the kidney capillaries, glomeruli and tubules. At the beginning, tubular damage occurs

followed by brisk tubular cell regeneration, which is accompanied by concurrent thickening of the glomerular basement membrane and interstitial fibrosis as an alarming consequence of chronic arsenic saturation in human body organs (Fowler & Weissburg, 1974).

Effects on the Reproductive System

Arsenic is considered an embryo-toxic element due to its detrimental effects on the overall reproductive procedure involving pregnancy and childbirth, hampering the maturity of the fetus depending upon the nature and span of exposure to it. Abnormalities related to pregnancy resulting in stillbirth, conceptus mortality, preterm

birth, and neonatal death are the crucial effects of arsenic absorption by pregnant women through drinking water (Ahmad *et al.*, 2001). The probability of these critical effects is reported to be almost six times higher for arsenic exposed pregnant women as compared to non-exposed pregnant ones (Von Ehrenstein *et al.*, 2006). Chronic exposure to arsenic, even a little above the recommended level via drinking water, has the effect of reducing infant birth weight and retarding the growth of the fetus in the uterus. Arsenic chronic exposure to pregnant women also hampers the excretion process through urine and creates disturbance in the distribution of metabolites, leaving toxic effects on the growing fetus, which has an impact at the different stages of pregnancy. So far, the discussion has been confined to the toxic effect of arsenic on females, but it is also prominent in the case of males showing the symptoms of improper functioning of the gonad due to a failure in testosterone synthesis along with symptomatic apoptosis and necrosis (Shen *et al.*, 2013).

Carcinogenic Effects

Arsenic is a very familiar toxic element because of its disastrous carcinogenic effect on humans since the late seventeenth century (Kligerman & Tennant, 2007). Since 1980, arsenic has been recognized as an element highly responsible for malignancy in different human organs by the International Agency for Research on Cancer (IARC). Risk of cancer enhances depending upon the medium of arsenic intake and its absorption in different body parts at a raised concentration, whether it is via inhalation involving people grasping arsenic-contaminated air through their exposures to different industrial operations or by ingestion of toxic arsenic polluted groundwater for drinking purposes for a lengthy duration. It has been evidenced from the exhaustive research conducted in different countries worldwide, like Argentina, Taiwan, Chile, USA, India and Bangladesh that there is a close attachment between exposure to arsenic and malignancy (Martinez *et al.*, 2011). In West Bengal, India, a huge mass faced the cruelty of death caused by the carcinogenic outcome of horrible skin lesions due to arsenic intake from drinking water or food; though the carcinogenicity arising from skin abrasion for chronic arsenic exposure could not be identified by those living in poverty because of economic obstacles (Rahman *et al.*, 2011). The noxious mechanisms of arsenic carcinogenicity in the human body involve abnormal chromosomal arrangements, oxidative stress, DNA repair inhibition, slow progressive alteration in DNA methylation pattern, transformed growth factors, rapid rise in cell generation, promotion or progression, gene amplification and its suppression (Kitchin,

2001). Several inorganic arsenicals, inclusive of arsenite, arsenates, and arsenic trioxide, result in malignancy of the skin, lung, liver, kidney, urinary bladder and prostate. In addition to inorganic arsenic compounds, some organic methylated trivalent arsenic species also show a probability of developing carcinogenic effects (Mass *et al.*, 2001). Genetic disorders due to transformations in the DNA structure and irregularities in the arrangement of chromosomes are found to be more prominent in symptomatic people suffering from arsenic induced skin diseases as a result of drinking polluted water than in asymptomatic ones because of their non-exposure to poisonous arsenic (Mahata *et al.*, 2004).

Preventive Measures

The current scenario of the universally perilous aftereffects of arsenic ingestion on human health needs extraordinary attention to protect mankind. Intake of a balanced diet with the requisite amount of vitamins and mineral supplements and pure drinking water are the necessities for saving themselves from the arsenic chronic syndrome. Considering all the different means of arsenic exposure for people, the spreading of a considerable number of deadly ailments through drinking water has become an alarming concern. Several preventive measures are very essential for weakening the severity of arsenic poisoning in humans. In the detected localities with unsafe levels of arsenic concentration in drinking water sources, there should be a rapid enhancement of chemical examination of water quality to reduce the concentration level by taking appropriate measures. The foremost objective is to identify the wells that are in use with a non-permissible level of arsenic present, providing the public with an alternative source of arsenic-free water. Digging deeper wells is a necessary factor for lowering the amount of arsenic, as shallow aquifers have a higher risk of arsenic presence. Harvesting rainwater can also be considered an alternative source for drinking purposes other than contaminated groundwater. Proper application of the methodologies for providing safe drinking water should be implemented on an immediate basis, as symptoms and signs arising from arsenic poisoning have been found to be reduced after 3–4 years after improvement of drinking water quality, with a reduced rate of fatalities. One notable way of keeping people safe from the curse of arsenic toxicity is the enhancement of awareness among the common people by increasing the publicity regarding the unfortunate effects caused by arsenic consumption well above the accepted guidelines by WHO in order to reduce their further exposures.

Since long ago, one promising way of intoxicating arsenic metal by isolating it from blood proteins is by chelation therapy using the common antidote British anti-lewisite (BAL) or dimercaprol (chemical name). In spite of its potency in protecting from chronic arsenic toxicity, BAL causes the simultaneous partial distribution of poisonous arsenic to the brain. Due to the toxic activity of BAL, other chelating agents such as DMPS (dimercaptopropane-1-sulfonate) and DMSA (dimercaptosuccinic acid) with a greater therapeutic index are used to reduce arsenic toxicity. With an increase in the time gap between exposure to toxic metals and chelation, the efficiency of the chelating agent gradually decreases or sometimes disappears (Kosnett, 2013). In addition to chelating therapy, biological monitoring is also needed for the detection of arsenic levels through the collection of hair,

blood, urine and toe nail samples. Whole hearted initiative is very much obligatory from government and non-government ends for inspecting the water quality of neglected rural areas through proper identification via research, considering it a challenge to provide arsenic-free or at least within the safe limit drinking water.

Conclusion

The global devastating essence of arsenic poisoning by acute and chronic ingestion leaves a matter of serious health concern predominantly to the people of rural as well as urban areas of countries like India and others, which are socially and economically unprogressive. This destructiveness caused by toxicity, showing the path of individual physical botheration even up to death, can take the shape of severity because of a huge gap between the awareness of people about the fate of such poisoning and the urge of the government, through its initiatives, to view an arsenic-free country by taking necessary precautionary measures. The poisoning nature of inorganic arsenic has been realized to be higher than that of organic ones. Arsenic intake above its permeable limit through food or drinking water causes sincere health anomalies related to the skin, respiratory system, nervous system, even loss of memory, cardiovascular system, hepatic system, renal system, reproductive system and deadly cancer of some organs, including the skin, lungs, liver, kidney and urinary bladder. The supply of ample quantities of nutritious food and pure drinking water should be enhanced in the affected areas in order to get some relief from the curse of arsenic virulence. A sincere approach to extensive, meticulous chemical testing of usable water and also biological analysis of human samples is very much recommended by the government and other laboratories at ground level to fight against such a slow-killing toxicant. More focus is needed on the research and development activities to counter the arsenic toxicity that is destroying humankind by increasing the accuracy of its detection, the application of chelation therapy, and other versatile, affordable scientific technologies without hampering the environmental ecology.

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