Contaminants and Its Worldwide Reported Health Impacts on Consumption of Polluted Water A Review

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Abstract: Water born diseases are becoming a global issue now days and especially becoming more severe for the low income countries. Children, old aged persons and with weak immune system are more susceptible to these diseases. Diarrhea is the first and rapidly appearing disease in water born diseases and became 6th burden disease on a global scale which is principally escapable. Same like other contaminants in drinking water as arsenic, lead, cadmium, silica etc also causing different water born diseases. We studied different contaminants in drinking water and their potential role in water born diseases besides its probabilistic health impacts in different countries. We tried to collect water born diseases which can be caused by contaminants in drinking water and observed that arsenic, nitrogen and other metals playing their dominant role in water born diseases. Chronic Health Quotient detected an insignificant range in different countries along with carcinogenic health quotient as well. There is no any reported insignificant dermal health quotient figure observed in any part of the world.

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Introduction

Water is considered as critical and the basic unit of nutrient to human life and vital for human's survival and livestock, animals and crops of the world. The main role of water in the body is digestion, transportation, adsorption of food, nutrients use, as well as waste and toxin elimination from body. It also plays an essential role in preparation of foodstuffs. Therefore availability, resources, management and distribution to realize the fresh water is of fundamental. An entire resource of fresh water on earth is only 3% which are non saline. 75% of it found in ice caps and glaciers which cannot be utilized easily or inaccessible. So only 0.08% of the world's freshwater is easily accessible and exploitable by humans [1]. As a result, rivers of developing countries in the urban areas are on the end point of discharges effluents from industries [2]. Pollution of water and environmental deterioration due to increased stress on river caused by urbanization with quick growth of population and land development besides river basin [3]. On the other hand, lakes considered as one of the most versatile ecosystem of the world are more sensitive to anthropogenic impacts and environment pollution [4], due to indiscriminate discharge of unprocessed municipal and waste water of industries. So discharge of lakes into rivers also makes it more pollutant especially during the time of low flow. The basic three sources which pollute rivers are (1) municipal waste water (2) Industrial waste water (3) agricultural runoff. In river Indus mostly discharge of untreated municipal waste water of cities and towns of Sindh [5]. In the soil zone level of contamination ground water determined by processes of adsorption/desorption, evaporation/recharge degrees and lateral intermixing [6].Global estimated for disaster of flood affected in last ten years (2001-2011) estimated nearly half of total victims of natural disasters and economic loss of almost US $185 billion [7].

Fig 1. Different sources of drinking water contamination (a) sewerage discharge (b) industrial waste water(c) animals involvements as a vector of contamination (d) agriculture runoff water

It is thought that global load of disease morbidity, mortality, socio-economic disruptions will be increased in floods and especially in low-resource countries has vulnerability to control major flood at highest level [8],[9],[10],[11], geographic and socio-economic factors as well as the baseline vulnerability of the populations affected due to Health consequences of floods [9],[12]. Disasters occurred in the countries and communities where resources are poor mainly due to disaster's greater vulnerability and meager management systems [9]. In the year 2002–2011 developing countries versus high resource regions worldwide the ratio of deaths linked to floods to be approximately 23 to 1 counted by the Centre for Research on Epidemiology of Disasters [7]. There are four principal categories of water related diseases.

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1) Water-born – By the contaminated water consumption (occurrence diseases: diarrheal, hepatitis infectious, guinea worm typhoid)

2) Water-wash –For personal hygiene use of scarce volumes (occurrence diseases: hepatitis infectious, typhoid, diarrheal, trachoma, Infections of skin and eye)

3) Water-base – For the transitional aquatic host (occurrence diseases: schistosomiasis, guinea worm)

4) Water linked vector – By the water associated with insect vectors (occurrence diseases: dengue fever and Malaria [13]

More chronic health risk by heavy metals, arsenic and the chemical parameters nitrate/nitrite can cause immediate impact. Human sewage is also typical contamination of water resources specifically introduces human fecal pathogen and parasites. Chemicals releasing as trigger from the flood water which are already stored in environment. Population which is living near to industrial or agricultural areas of flood-impacted having toxic exposure-related health impacts [14],[15], related outcomes of health and contaminations in overstated population is scientifically verified as casual pathway between floods. Diseases which caused by such kind of contamination exposures are gastrointestinal, neurological, liver, kidney, cancer and cardiovascular [14],[15]. Flood stress consequently of direct or longer term losses deteriorates physical and social functioning [16],[17],[18]. In flood contemptible hygiene and poor condition of clean drinking water due to risk of elevated gastrointestinal (GI) disease. The risk is greatest in low incoming countries like Bangladesh, all through the floods of 1998 and 2010 lead diseases of diarrhea and fever in more half of the affected population, suffered overflow of two thirds of drinking water sources and 97% of latrines in badly affected villages [19]. Hepatitis E attributed primarily to the contamination of water resources and outbreaks are endemic in flood areas (person-to-person transmission accounts only for up to 2.2% of new cases by [20], in low source countries most of the population are immune that’s why Hepatitis A is infrequent [21]. United States Reports [22] and South Asia [23] exacerbation of ARIs exposed, rashes of skin and earache are widespread complaints of post-flood and mainly common type of infectious disease happening after floods [24]. Increase in low-income countries diarrheal deaths may cause Long-term mortality due to floods directly [25], indirect impacts of disasters are health impacting, economic systems, food, exacerbating poverty, non-transmissible diseases and malnutrition. Mortality rate in affected population may be continuously increased through the first year following a flood by up to 50% [11]. Outcomes of flood increasing vulnerability to adverse health outcomes by disasters (CDRCs) Chronic disease and correlated conditions can be worst [26] and non fatal injuries has been found to outgrow burden in the immediate post-flood period

[22],[26]. The 1.1 billion of one sixth of humanity haven't access to fresh water within one kilometer from their home indicated in the reports of WHO and UNICEF 2000. In each year approximately 2 billion deaths occurred by water born diseases. Worldwide around 1 billion people lack proper drinking water, thus a paramount importance of matter that purity and cleanliness of the water be ensured [1]. Due to poor water and sanitation, the greatest health burden faced by children in each year the deaths caused 1.73 million and disability over 54 million, diarrheal global burden of disease caused a total equivalent to 3.7% of the disease because of deprived water supply, sanitation and hygiene relation, now diarrheal disease becomes a disease on global scale 6^{th} highest burden which is principally escapable [27]. Due to unreachable safe and limited water supplies that increases poverty, poor health and enhancing need for water purchasing and economic loss [28]. If action will not be taken for the essential needs of human for the safe water in 2020, estimated 135 million people may die by preventable water-related diseases, 76 million people will die from water related diseases, 34-76 million people will depart the life from these diseases [29].

1. Physical Characteristics

1.1 Odour and Taste

The human smell of rotten egg appeals as pungent odour. The high content of salts causes saltiness of the water. Humid compounds, algae, dead fishes, dissolved gases in water and wastewater and other sources probably show odor and taste [30].

1.2 Electrical conductance

It is used as a measurement of total dissolved solids in water. Status of inorganic or organic pollution qualitatively reflects by electrical conductance [31].

1.3 Total Dissolved Solids

In health risk, the total dissolved solids (TDS) did not play a direct role but high salt contained water's extended consumption of TDS can cause kidney stone when TDS is above 500 ppm. The occurrence of TDS widely reported from various parts of the country, and may also have a laxative effect mainly upon transits because of elevated concentration of TDS which increases unwanted taste and causes gastrointestinal irritations in humans [32].

1.4 Salinity

The dissolved salt contents in water represent salinity. Frequent renal stones and asthmatic problems have been found in the population using water with high salinity [33].

1.5 Turbidity

Turbidity is due to suspended solids and gauges the vagueness of the drinking water, it is commonly used as a proxy compute as hazards of microbial contamination and the efficiency of the treatment of public drinking water [34]. Planktons, industrial wastes, iron, decay organism and manganese oxides may be reasons causes color measured as NTU Nuphelometric turbidity unit [30]. Sometimes turbidity gauge microbial contamination of unprocessed and treated water in several studies had shown a correlation [35],[36]. In the aged population in Philadelphia over the phase (1992–1993) create an involvement stuck between turbidity levels and hospital burden for GI illness [37].

1.6 pH

pH is a –ve log of Hydrogen ion concentration. It has effects on metal ion solubility and existence of some pathogens endurance water quality pH changes, bitter taste of drinking water attributes a high range of pH and sour taste results low pH [38].

2 Chemical characteristics

2.1 Alkalinity

Total alkalinity in natural water comprises the $CO_3^{2-}$and HCO_3 with hydroxyl [39],[40]. Environmental carbon dioxide (CO_2) solution of carbonate mineral along with rocks similar toward calcite as well as dolomite, weathering as silicate minerals similar to feldspar via carbonic acid,a decrease of nitrate and sulfate via organic stuff, and oxidation of organic material source to originate from carbonates and bicarbonates. During low-flow period is a raise in CO_3^{2-} and HCO_3^{-}, atmospheric CO_2 forming a weak acid of HCO_3^{-},, supply to dissolving the enclose rocks; this may be allowed in the direction of the rain water and the overspill water which dissolved generally, CO_3^{2-},and HCO_3^{-} among anions lower concentration recorded [41].

$$CaCO_3 + CO_2 + H_2O \rightarrow Ca^{2+} + 2HCO_3^-$$

Inverse relationship have been found in between temperature and dissolved CO_2, $HCO_3^-$and Ca^{2+} in the river water discharged by the reaction of HCO_3^-minerals with dissolved carbon dioxide (carbonic acid) releases [42], preventing from acidosis and alkalosis, HCO_3^- is a vital buffer used for the acid/base balance. In severe cases, may cause coma when acidosis unconstructively impacts cardiovascular and nervous systems. Kidneys, muscle cramps and lungs, are significant regulators of the acid/base, arrangement my cause due to alkalosis flanked by the intra-cellular and the extra-cellular liquid equilibrium among cations and anions as essential for regulating osmotic pressure [43]. Seems importance of HCO_3^- in drinking water, calcium and phosphorus control and reduce the bone resorption pace by neutralization of diet net acid load [44].

2.2 Total Hardness

Mixed Calcium along with magnesium salt as of the adjacent ores are sources of the total hardness in water. Based on the total hardness, water was classified as soft (< 75 mg/L), fairly hard (75–150 mg/L), hard (150–300 mg/L) and very hard (300 mg/L) [45]. Increased boiling point of water and resisted creation of soap lather and precipitation of calcium carbonate may cause scaling on water supply systems, elevated hardness cause disease of kidney, bladder, stomach disorder, calcification of arteries, urinary concretions may cause due to High TH in drinking [33]. Atopic eczema in school children also reported to cause increase risk due to hard water [46]. Occurrence of cardio-vascular disorders, anencephaly, urolithiasis, parental death shows a few indicative confirmations that due to continuing utilization of enormously hard water (300 mg L^{-1}) might escort to an amplified [47],[48]. Against cardiovascular diseases stiff water with elevated concentrations particularly Ca and Mg was originate to be defensive [49],[50],[51]. In diverse malignancies [52],[53],[54],[55] and diabetic mellitus reported as hard water has a caring significance conflicting to death caused [56],[57].

2.3 Calcium and Magnesium

Indispensable nutrients used for plants and animals are calcium and magnesium and nutritional benefits for people provided by presence of $Ca^{2+}$and Mg^{2+}in drinking water used for cell development of bones and for nervous system also considered as essential element and basic constituent of soft tissues, bones, teeth and is indispensable in numerous metabolic phenomenon of the body, Calcium is also involved in bones that’s why it is a significant ingredient for the human body [58]. The Mg is central metal of the chlorophyll and play role in photosynthesis for food production for plants. Chief partners in the direction of the water hardness are $Ca^{2+}$and Mg^{2+}, may be a bigger hazard of kidney stones is one probable unfavorable outcome from intake of elevated concentration of $Ca^{2+}$for extended times [59], gastrointestinal zone usually confines the quantity of calcium captivated that’s why short period ingestion of bulky concentration of Ca^{2+} did not normally have some unfavorable consequence except important blood calcium limits (hypercalcemia) may cause urinary tract calculi, hyper calciuria, soft tissues, calcification similar to kidneys and in arterial walls and self-control of bone remodeling may cause due to intake of surplus calcium for a extended instant [60].

2.4 Chloride

Chloride Cl^- acting a significant role as in harmonizing blood plasma electrolytes other than physiological disorders can create due to its high concentration. Potable water acceptable level of chloride limit within water is 250 mg $L^{-1.}$, drinking water shows a salty taste and laxative upshot due to surplus concentration of Cl^- in drinking water for those who are not familiar to it [61], from health point of view about 2,095 mg L^{-1} it could be dangerous as may cause hypertension, osteoporosis, renal stones and asthma, hazard of stroke and left ventricular hypertrophy may be crucial due to high consumption of chloride [33].

2.5 Sodium

If high sodium amount present with chlorides or sulphates create the water saline and becomes unfit for human consumption and irrigation purposes, also may exert osmotic stress on the biota in the water [62] and reasoning of hypertension and elevated blood pressure in humans [63]. Adolescents living in a community with high sodium content in drinking water reported elevated blood pressure [64], osteoporosis, renal stones, asthma, hypertension and enhanced risk for stroke, left ventricular hypertrophy may be reasoned due to high utilization of salts mainly NaCl [33].

2.6 Potassium

Water intake is usually < 0.1 % of Potassium (K) through the adult's average daily intakes [65]. Adequate quantity of K is also incredibly important intended for usual body functions like other light elements. Heart troubles, hypertension, muscle flaw, bladder flaw, kidney evils and asthma can cause due to low concentration of K while ovarian cysts, quick heart beat, cystitis, condensed renal task and irregular protein metabolism can cause due to its high concentration [66].

2.7 Silica

Silica amount around 7-10 g/mL constitutes a good source of silicon in drinking water [67]. Silicon found second most prevalent element after oxygen, there are various kinds of silica which subsist in environment, silicon considered as silica oxide viz silicon dioxide which is water insoluble and monochrome to white colour. Family of silicates formed when associated with metals or minerals as silicicacid (ortho, meta, di, and tri-silicates), these are present in surface and well water in series of 1-100 mg/L referred as water soluble forms of silica. Humans predominantly absorbed orthosilicic acid in kidney, liver, aorta, bone, tendons and shortage induces deformity in cranium and peripheral bones, weakly bent joints, condensed stuffing of collagen, cartilage, and commotion of mineral equilibrium in the femur and vertebrae [68].

2.8 Sulphate

Gastrointestinal problems, dehydration, diarrhea, catharsis, and annoyances may be linked by the intake of water contain SO_4^{2-} [33]. People who are consuming water containing sulphate in concentrations exceeding 600 mg/L cathartic effects are commonly reported [69], sulfate with a median concentration of 264 mg/Land a range of up to 2787 mg/L are in the risks for diarrhea in infants exposed to tap water [70]. High exposure of sulfate concentration sub-population may be more sensitive to cathartic effects due to potentially elevated hazard of dehydration from diarrhea that may be reason by elevated limit of sulfate in drinking-water; children transients and elderly are such populations [70],[71].

2.9 Nitrate

Involvement of nitrogen in fertilizers as in agricultural usage and as of waste of human and animal by sewage discarding way and livestock services cause nitrate as a widespread environmental contaminant. When levels of nitrogen in water is more than 10mg/L, above the nitrate 50% ingestion obtained from drinking water. A strong correlation was found between colorectal cancer and drinking water nitrate found in Slovakia. Elevated drinking water nitrogen originates to some extent important digestive organ and peritoneum cancer incidence found in ecological studies. High rates of nitrosation among certain expected subgroups associated with drinking water nitrate experimental an amplified hazard of colon cancer and decreased colon cancer mortality [72]. Due to excessive NO_3^-in drinking water, methaemoglobinaemia caused in birth malformations infants goiter, gastric cancer and hypertension [61].Blue baby syndrome commonly known as methemoglobinemia is a most common health impact of blood disorder due to nitrate. Enhanced hazard for respiratory region infections and goiter expansion in children can also be the cause of high levels of nitrates [73],[74], elevated possibility for cancer of ovary and bladder, diabetes mellitus of insulin reliant and effects of genotoxic at chromosomal rank are also linked with nitrates in water [75], an eminent hazard for anencephaly was set up in California and connection among motherly peri conceptional disclosure of nitrate from drinking water and diet relationship among neural tube defects and nitrate also indicated an earlier Australian study, risk of bladder and ovarian cancers positive trends found among municipal water nitrate limit [76].

2.10 Arsenic

In various countries Arsenic (As) is documented as a big hazard to public health like India, China, Nepal, Bangladesh, Vietnam, and Myanmar [77]. In Sindh province the arsenic found in water with over 10-50 ppb and has been exposed of about 16–36% of population [78]. Manchar Lake is a largest Asian lake and chief source of water for irrigation, household, and fishing purposes, main source of Manchar Lake (Sindh) contamination is Main Nara Valley Drain (MNVD) because of that As contamination has been found in the lake [79], emissions and processing industry, dissipate water of the ore mining, dye make up services, thermal power plants, tanneries and purpose of firm pesticides insecticides, herbicides are the most serious sources of As pollution [80], some type of cancers have been found exposed by Arsenic contamination in which cancer of skin, lung, liver and bladder have been found and known as a carcinogen in humans [81] due to Arsenic exposure Lung cancer is well known to result [82]. As contamination have been found above 50µg/L and even found in exceed 200µg/L in Sindh [83] 96µg/L in underground water and 157µg/L in water on surface has been acknowledged [84]. As exposure to the elements children of 13–14 years old age identified skin lesions at 65.5% and 78.3% rate in males and females after 6 years had limits that Increased 0.10 mg As/100 g hair and for nail as well [85], abnormal pigmentation found 0.32 mg As/100 g and 0.61 mg As/100 g of As in hair with prevalence presence (100%) and 0% respectively in Chile [85]. Darkening of skin found at 0.001 mg/L of As from water with 3.2% and 0.1–0.39 mg/L with 6.6% prevalence respectively and Unexplained skin rashes found at 0.001 mg/Land 0.1–0.39 mg/L As from water with 10.8% and 7.7% prevalence respectively in USA [86]. Skin signs found at < 0.05 mg/Land 0.05– 0.99 mg/L of As from water with 10.0% and 10.8% prevalence rate respectively in Japan [87] Keratosis found at 0.05–0.8 mg/L As from water with 1.6% and 10.8% prevalence rate and hyper pigmentation found at 0.05 – >0.8 mg/L As from water with 11.0% and 22.7% prevalence rate in India [88]. Skin lesions found at <0.15 mg/L- >1.00 mg/LAs from water within 20.5% and 37.90% prevalence ratio in Bangladesh [89], dose–reply association among As revelation and skin lesions in areas of Inner Mongolia. Charge of As-induced skin lesions were 44.8% or 37.1%, correspondingly in two As-tainted areas where in between 69.3% - 96.2% wells were found with As in over kill of 0.05 mg/L in water. The occurrence of skin lesions was elevated in older populace over 40 years old and reflected no sex differences [90]. Skin malignancy found at 0.59 mg/L- > 0.60mg/L As in water with exposure rate more than 60 years prevalence rate (per 1000) for male

48.1% - 9.1% for female in Taiwan [91]. < 0.30 mg/Ll - > 0.60 mg/L exposure with Lowest years of 20 and more death tempo (per 100000) in Taiwan 2.03 for male, for female 1.73 [92], interior malignancies age-attuned death ratios of numerous inner malignancies including liver, lung, kidney, bladder and prostate were much linked to enhancing As concentration of drinking well water between populace 20 years old or elder [92]. Well-known and note worthy sites of cancer were kidney, bladder, skin, and lung, In Lung 0.3 – >0.60mg/LAs in water mortality rate (per 100000) 49.16 for male and 36.71 for female, In Bladder 0.3–> 0.60mg/L As in water mortality rate (per 100000) 22.64 for male and 25.60 for female. In Kidney 0.3– >0.60mg/L As in water mortality rate (per 100000) 8.42 for male, 3.42 females in Taiwan [92]. Bladder whole collective As < 8 mg/L years- > 13 mg/L years (year dosage 30–39 year intermission among contact phase and surveillance) response found by for smoker odds ratio 1.00 /1.00 for non smokers in USA [93]. In drinking water Lung As concentrations <0.05 mg/L As - >1.00 mg/L As with standardized mortality rate below detection (BD) – 0.16. Of drinking water, Urinary expanse As conc<0.05 mg/L As - >1.00 mg/L As with standardized mortality rate BD 0.31. Drinking water Liver As conc<0.05 mg/L As - >1.00 mg/L As with standardized mortality rate 0.00–0.07. Drinking water Uterine As conc<0.05 mg/L As - >1.00 mg/L As with standardized mortality rate BD- 0.13 Japan [87]. Kidney <0.04 mg/L As, water central point 0.04– 0.178 mg/L As, elevated: >0.178 with standardized death rate SMR (standardize mortality rate) 0.87 for male and 1.00 for female. Lung low: <0.04 mg/l As, middle: 0.04– 0.178 mg/l As, high: >0.178 mg/L As with (SMR) standardized mortality rate male 0.92 and 1.24 female [94]. Age-attuned death rates of diseases of peripheral vascular and disease of cardiovascular have been associated to utilization of well water in Taiwan by way of rising As concentration in populace of old 20 years or elder [92]. substantial dose–reply affiliation was pragmatic linking the As exposure, incidence of hypertension, via each As level in drinking water or collective As revelation in Bangladesh between the populace existing in As-polluted area [95],[96]. There are several reports on dose-dependent relationship between As exposure and respiratory disease mentioned that the prevalence of cough, shortness of breath, and chest sounds in the lungs rose with increasing As concentration in drinking water. Age and gender-adjusted prevalence rate of glucosuria was related to increasing As exposure, using either an average As concentration from well water ranging from non detectable to 2.04 mg/L, or a cumulative As exposure index among residents 30 years old or older in Bangladesh [95],[96].

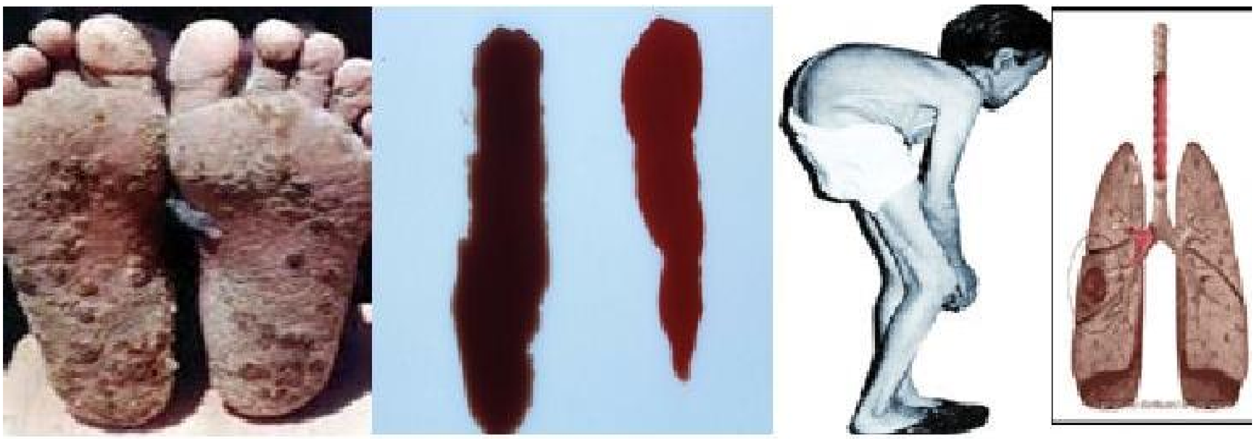

Fig.2. Diseases which can be caused due to presence of different contaminants in water.

2.2.1 Aluminium

A relationship among Alzheimer's disease and aluminum in drinking water showed number of epidemiological studies [97],[98]. Patients through chronic renal malfunction are too in the very vital clinical troubles connecting trace metal toxicity by poisoning of Al [99].

2.2.2 Chromium

Carbohydrate metabolism in the body plays vital role by Chromium which is not toxic itself [100] except a few of its compounds particularly in hexavalent position source [101, maximum allowable concentration is 0.05mg/L in drinking water described by WHO, for normal body functions exact amount of Cr is desirable, on human, animal, and in vitro evaluation data found that a well reputable Carcinogen is the hexavalent Cr [102],[103], Cancer caused of kidney problems, liver and genotoxic carcinogen due to toxicity caused by its high concentrations [104],[105].

2.2.3 Lead

Lead (Pb) is a standard element of the earth's crust [106], as domestic paint, vehicle exhausts and a waste of industries causes lead contamination in drinking water. In trace amount it naturally occurs in soil and water, systems of the body, for example, immunological system, reproductive, nervous, cardiovascular, digestive, hematopoietic in addition to skeleton and kidneys affected adversely due to longer time overdoses of Pb [107],[108],[109]. The decline in the hemoglobin production, trouble in the performance of kidney, joints, cardiovascular systems, reproductive, and central and peripheral nervous systems chronic damage caused by Pb toxicity it arises from both natural and anthropogenic sources[110]. During pregnancy nevertheless at short concentrations lead is an extraordinary threat, Developmental stoppage, stumpy birth weight and miscarriage of fetus may cause [111],[112].

2.2.4 Cadmium

From toxicity point of view there is a great concern about element Cadmium (Cd), acute and chronic toxicity in humans may cause by Cadmium as a lethal metal, acute gastrointestinal harms, for example, vomiting and diarrhea may origin because of ingestion of cadmium [113], kidney damage may cause though chronic disclosure to cadmium for an extended time [114], troubles in reproduction [115],[116],[117] injure of bone [118],cancer [119]. Chronic and acute both health belongings problems in living organisms can cause due to Cd exposure [120], like diseases of itai-itai (ouch-ouch), skeletal damage, Kidney damage includes the chronic things [121],[122], blood damages, kidney, liver and nausea, vomiting, salivation and renal stoppage may cause by Cd, humans, and animals shows cancer by experimental data, mutation may cause due to elevated concentration of Cd [123].

2.2.5 Copper

Cancer can be induced by copper (Cu) has now been confirmed to be an aspect [124], acute copper hazards are unlikely to occur due to the odor of copper can simply be sensed by human beings [125]. Diarrhea and other gastrointestinal symptoms can be caused because of high concentrations of Cu in drinking water [126].

2.2.6 Iron

Natural physiology of living organisms Iron (Fe) is one of the majority rich metals in soil and is an indispensable constituent for animals and plants mutually its shortage and excess can be injurious, It is a less common condition of prominent concentrations in normal water assets over exposure but like cancer quite a lot of serious health evils can be caused [127],[128],diabetic mellitus [127],[129],[130], diseases like liver ,heart [131],[132], in addition to disease of neurodegenerative [133],[134]. Diarrhea and lowered appetite in animals have been associated with High concentrations of Fe [135].

2.2.7 Cobalt

Co is one of the obligatory metals for usual body regulations as a metal constituent of vitamin B-12 [104]. However, polycythemia, irregular thyroid, artery and right coronary artery problems, over-production of red blood cells (RBCs) can cause by lofty Co intake via consumption of contaminated food [136].

2.2.8 Manganese

Psychological diseases, for example, Alzheimer's and Manganism can be caused by elevated concentrations of Mn and Cu in drinking water [137]. Though, significantly lower to ingestion beginning food than a revelation to Mn from drinking water is usually [138]. By the Wasserman et al 2006, 10 year-aged kids can also be affected by elevated Mn pollution in drinking water. Mn distributed in all tissues and organs of human body and has been recognized as an essential element, get accumulated in kidney elevated level of the mean concentration of Mn, Manganese Psychosis caused by liver and bones, which is an irreversible brain disease [139]. Harsh malfunctioning in the nervous structure with the brain as the chief target site caused by the contact to extreme doses of Mn [140], symptoms alike to persons of Parkinson's disease during its worst appearance may direct to an eternal neurological chaos [141],[142].

2.2.9 Nickel

A broadly dispersed element in the atmosphere can originate in air, water, and earth as “Allergen of the Year 2008” [143]. Nickel catalyst used as hydrogenation of ghee manufacturing and causes severe health problems due to ingestion of Ni-sulfate and Ni-chloride cause fatal cardiac arrest [104], Nickel allergy get in touch with kidney problems, dermatitis, respiratory tract cancer, lung fibrosis, cardiovascular diseases, and variety of adverse effects can be caused by Nickel compounds [144],[145],[146].

2.2.10 Zinc

Deficiency of Zn caused poor cut curing, compact work ability of respiratory muscles, immune malfunctioning, anorexia, diarrhea, hair failure, dermatitis (acrodermatitis, enteropathic) and depression, even as Zn hazard becomes a sideroblastic anemia, adequate quantity of Zn is as well incredibly important for usual body regulations [105].

3 Bacteriological contamination

To identify whole and/or Fecal Coliforms, microbial examination of water is regularly accepted, as a pointer for water infectivity with diseases causing germs and pathogens, normally not damaging to humans but their occurrence of Coliforms commonly occur in the environment. Fecal Coliforms and E. coli being there is used as a marker for water contagion with waste of human-animal [147], extremely contaminated with bacteriological pollution found water sources together with ground aquifers, rivers and lakes in nearly all of the regions in the country [148], bacterial contamination further vulnerable to similar open dug wells and short water table make it In rural areas [149],[150], microbial pollution in drinking water is a chief provider in water-born hazards alike to typhoid, dysentery, nausea, gastroenteritis, diarrhea, and additional health-linked problems like diseases, [151],[152], personnel with worn out immune system and children especially [151].

4 Health Quotient

Although some heavy metals (e.g., Cu, Mn and Cr) are essential for humans, their presence in excess amount may be toxic [153],[154]. On the contrary, some metals (e.g., As, Hg, Cd and Pb) are highly toxic at a very low concentration with no known benefit for human health [155],[156]. When entering into the environment, these metals can disrupt not only the aquatic ecosystem but also the human health [157],[158]. Human health risk assessment is an effective approach to determine health risk levels posed by various contaminants of metals [159]. This method has been applied to assess the potential adverse health effects exposing to contaminated water [159],[160],[161],[162],[163],[164],[165],[166],[167],[168],[169],[170],[171],[172].,There are many reported methods which are being practiced to determine health quotient of dissolved metals like CDI(oral) [173],[174],[175],[176],[177].,CDI(dermal) [178],[179],[180],[181],[182],[183],[184],[185],[186],[187],[188],[189] and ADD (average daily dose) [190],[191].ADD values of current As study [192] were lower than those in Bangladesh drinking water (5.00E_02 – 5.00E_01 mg kg^{-1} day^{-1}) reported by [193] Karim and in Vietnam drinking water (5.00E_03 – 4.39E_01 mg kg^{-1} day^{-1}) by [190]Nguyen et al. 2009 but more than kohistan region north pakistan drinking water surface water contaminated with As had ADD values ranged from 0.00mg/kg-d to 5.61E_05 mg kg^{-1} day^{-1} and while the people who consumed groundwater, had ADD values ranged from (5.50E_07 - 4.64E_04 mg kg_1 day_1) by [176] .Which reflects area wise variations in average daily dose of Arsenic with respect to impact on local water drinking communities and involvement of contamination sources. Carcinogenic risk is defined as the incremental probability that an individual will develop cancer during one’s lifetime due to chemical exposure under specific scenarios [194],[195]. Carcinogenic Risk Assessment of Arsenic HQ found more than the normal range in many samples of different sources of district jamshoro that is also an alarming and threaten indication for the consumers of that drinking water which is contaminated by arsenic in the both wet and dry seasons [196]. Arsenic non carcinogenic risks were higher than the level of concern for 19% of the population, where as carcinogenic risks were 10^{-4} for 46%, and 10^{-6} for 90% of the population in Turkey [197] but in our study findings it were 10^{-6} for 100% in both phases and were 10^{-4} 45% in phase I and II. Health Impacts have been found more concerns in Phase II than Phase I as HQ (0ral) that reflects the concentration of contaminated source. Dermal Health Quotient of all the type of sources with respect to different metal found less than <1 HQ for Adult but in closer one with unity identified HQ of Child that indicate future alarm for HQ dermal for Child if same contamination flow will remain to continue in the drinking sources, with the previous studies. Wu et al. (2009) Nanjing, China and Zahida Karim (2011) Karachi [198],[184] reported that HQs dermal suggesting that these pollutants could pose a minimum hazard to local residents that statement resembles with our study findings and HQ dermal was also found lower than the HQ oral.

Conclusion

In this review, we tried to cover up all water born diseases burden which may be caused by the different contaminant presence in drinking water and sources of contamination and reasons with their health quotient. It observed that water born diseases like itai itai, methemoglobinemia, black foot, silicosis and etc have been reported by world's different authors as a serious concern. Arsenicosis has been reported as an alarming concern in water born diseases and showed that different diseases may cause with varying its concentration. Chronic Health Quotient also observed in different parts of worlds with variations in results. Carcinogenic health quotient has also been detected with the calculation that focused us on the seriousness of diseases which are being created by different contaminants. There is no any reported dermal health quotient figure in any part of the world observed in our study.

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