Journal of Crop and Weed, 19(1): 110-118 (2023) ISSN- O : 2349 9400 ; P : 0974 6315

http://cwssbckv.org
www.cropandweed.com

Effect of pesticide and heavy metal toxicants on fish and human health

B. K. CHAKRABORTY

Mud eel, Mud crab, Aquaculture and Management Center, Department of Fisheries, Bangladesh & Supervisor, Bangladesh Agricultural University

Received : 10.01.2023 ; Revised : 31.01.2023 ; Accepted : 17.02.2023

DOI: https://doi.org/10.22271/09746315.2023.v19.i1.1669

ABSTRACT

Data and information sources are used from the direct interview with the individual, publication of the Department of Fisheries (DoF) and related non-published grey literature. Fishes are important sources of proteins, lipids and micronutrients for humans and domestic animals. With the increase in the human population, many types of organic and inorganic contaminants such as plastics, pharmaceuticals, pesticides and heavy metals are released by humans into the environment, both aquatic and terrestrial. Pesticides are used very extensively in agriculture, forestry, public health and veterinary practices. The survival of terrestrial, aerial, and aquatic organisms including human beings has been endangered by pesticides and heavy metal. The three major pesticides are herbicides (weed control), insecticides (insect control), and fungicides (Mycotic control), but the more acute toxicity are insecticides. The contamination of surface waters by pesticides is known to have ill effects on the growth, survival and reproduction of aquatic animals. The major Chemical groups of insecticides that are usually applied Organophosphate, Carbamates, Organochlorine, Pyrethroids and Necotenoides. The insecticidal residues and heavy metal contaminate the water are mainly due to the intensive agriculture combined with surface runoff and surface drainage. Insecticides lead to decrease rate of growth, reproductive disorders, causes spinal deformities and effects on gills, liver, spleen, kidney and renal tubules, brain, neurological, behavioral disorder and genetic defect are other biological indicators of exposure to insecticides. Aquatic ecosystems are at much higher risk due to the additional toxins being released. Increasing pollution of groundwater and surface water has additionally contaminated water quality, effectively reducing the supply of fresh water for human use. The persistent toxicity and the ability of higher concentrations of heavy metals, metalloids and pesticides to accumulate in water and sediment allow them to become severe poisons for all living organisms including human being.

***Keywords*:** Pesticides, insecticides, heavy metal, herbicides, toxicants, water contaminants.

Fisheries and aquatic resources (ponds, rivers, streams, canal, seas and oceans) are supplying peoples with long term benefits. Those benefits are direct financial ones that provide employment, profit and save money. Fish is an important source of food for humans and also a key component in many natural food webs. The high quality protein from fish is better for human health than that in meat and poultry. Fish consists of 15-24% protein; 1-3% carbohydrate; 0.1-22% lipid; 0.8-2% inorganic substances and 66-84% water (Ackman *et al*., 2012). Fish plays an important role as it is an important source of trace minerals and calcium. It also provides calories, nutrients such as fat, vitamins, elements such as, phosphorus, sodium as well as trace elements.

There are industrial hazards and safety concerns in the aquaculture industry. Some practices have caused environmental degradation. Public perception to farmed fish is that they are "cleaner" than comparable wild fish. Some farmed fish have much higher body burden of natural and man-made toxic substances, e.g., antibiotics, pesticides, and persistent organic pollutants, than wild fish. These contaminants in fish pose health concerns to unsuspecting consumers, in particular pregnant or nursing women. The regulations and international oversight for the aquaculture industry are extremely complex, with several agencies regulating aquaculture practices, including site selection, polluted control, water quality, feed supply and food safety (David *et al*., 2009).

Application of insecticides used for control a wide variety of insectivorous and herbaceous pests which diminishes the quantity and quality of food production. The synthesized chemical compounds have significant drawbacks, as well as insecticides threaten the long-term survival of major ecosystems disorder environmental relations between organisms and the loss of biodiversity. The major Chemical groups of insecticides are usually applied Organophosphate, Carbamate, Chlorinated Hydrocarbons, Pyrethroids and Nicotinoids. Contamination of water with insecticides is mainly due to intensive agriculture combined with surface runoff and surface drainage. Fishes are particularly sensitive to the environmental contamination of water. Insecticides may affect significantly certain physiological and biochemical processes which can cause serious impairment to health status of fishes (Banaee, 2013).

Email: bborty@gmail.com

How to cite : Chakraborty, B.K. 2023. Effect of pesticide and heavy metal toxicants on fish and human health. *J. Crop and Weed*, 19(1) : 110-118.

Fish caneasily absorb pollutants from the ambient waterand from their food and then deposit them in thetissue through the effects of bio-concentration and bioaccumulation. In this regard, heavy metals have long been recognized as an important pollutant due to their toxicity and ability to accumulate in marine organisms. Some of the identified toxic metals are arsenic, beryllium,cadmium, chromium, cobalt, tin, zinc, copper, iron, lead, manganese, aluminum, mercury, nickel and selenium.

Methodology

A semi-structured questionnaire was developed. Primary data was collected by focus group discussion (FGD), local ecological knowledge (LEK) and direct interviews with the individual respondent. Questions were asked systematically, with framed questionnaire. The study, being a rapid survey, gives only a broad picture of water pollution, pesticides and heavy metal health hazards for the population. Current data were collected through different stakeholder related to fisheries and health hazard sectors. Secondary data were collected mainly from the Department of Fisheries (DoF) Labratories, BCSIR Laboratories, Dhaka (Dhaka Lab) relevant literature and internet sites.

RESULTS AND DISCUSSIONS

Impact of water pollution on health of fish and shellfish

There is an evidence of pollution affecting the health of fish and shellfish all over the world. Water pollution, has been the result of urbanization and industrialization. This has resulted in some major rivers becoming devoid of or deficient in fish stocks. The pollution may influence the health status of fish and shellfish has increased over the past 20 years. Original attention was given to epidermal diseases, including fin rot in demersal fish, and protozoan diseases in mollusces in the severely polluted areas. The diseases in fish and shellfish are localized, but there is a concern amongst researchers that certain cancers, especially liver tumors, occurring in demersal fish inhabiting polluted estuarine and coastal waters, are related to the release of chemicals, e.g., hydrocarbons, pesticides and heavy metals (Buck, 1993).

Pesticides toxicity infish

Pesticides are categorized according to their target use to many groups such as Insecticides, Fungicides, Herbicides, Rodenticide, Nematicides, Acaricides, Molluscicides, Homicides, Ovicides and so. The three major pesticides are herbicides (weed control), insecticides (insect control) and fungicides (Mycotic control). Nematicides are pesticides used to control soil, leaf and stem-dwelling nematodes (round worms). An acaricide (pesticide) control mites and ticks (Louis, 2013). Bioavailability refers to the amount of pesticide in the environment available to fish and wildlife (Wikipedia, 2013). Some pesticides build up in food chain. A small amount of pesticide in water is absorbed by water plants which are, in turn, eaten by insects and minnows. Fish can pass these poisons on to humans. Perseverance of pesticides refers to the length of time a pesticide remains in the environment.

Negative impact of pesticides

The main disadvantages of pesticides are including their toxicity to humans, animals and useful plants. Pesticides poisoning kill fishes, frogs, turtles, mussels, water birds and other wildlife species, including rare and enlarged peregrine falcon, bald eagle, and osprey. Pesticide use is one of many factors declining of fish and other aquatic species. Pesticides are capable of killing *Monopterus cuchia* and other aquatic life directly and within short period of time. Several pesticides have shown to cause fish to seek suboptimal water temperature and subjecting them to increase danger of disease and predation. Some herbicides have been exposed to inhibit normal migration to sea, resulting in severe disruption of the life cycle. The Indirect effects of pesticides are affected fish with their food supply, altering the aquatic habit, reduces the growth and probability of survival of the fish (Shankar *et al*., 2013; Louis *et al*., 2013; Dutta, 2003; Ewing, 1999).

Route of pesticides fish exposure

Fish and aquatic animals are exposed to pesticides in three primary ways. Dermal, direct absorption through the skin by swimming in pesticide-contaminated waters, inhalation, by direct uptake of pesticides through the gills during respiration and orally, by drinking pesticides contaminated water or feeding on pesticide contaminated prey.There are some secondary causes that cause the exposure of fish and aquatic lives (Fauna) to pesticides and eventually lead to toxicity. Through the consumption of another aquatic lives that has been poisoned by a pesticide. Fish feed on insects death is killed themselves if they eat containing large amounts of toxic pesticides or byproduct insect. The water column, usually first comes in contact with pesticides, and Organic substances (algae, vascular hydrophytes, leaf litter, branches and mosses) also causes secondary causes (Kings *et al*. 1980, Spradley *et al*., 1985).

Effect of the three main types of pesticides on fish and shellfish

1. Insecticides

The major route of insecticides to water ecosystems in urban areas is through, rainfall, runoff and

atmospheric deposition. Other sources of water contamination by insecticides are from municipal and industrial discharges. Most insecticides find their way to rivers, lakes and ponds and have been found to be highly toxic to non-target organisms that inhibit natural environments close to agricultural fields (Arjmandi, 2010). Fishes are particularly sensitive to the environmental contamination of water. So, pollutants such as insecticides may significantly damage certain physiology and biochemical processes that different kinds of insecticides can cause serious impairment to physiological and health status of fishes (Banaee, 2009).

Classification of insecticides is according to chemical groups:

a. Organochlorides

Organochlorides are Aldrin, Chlordane, Chlordecone, DDT, Dieldrin, Endosulfan, TDE,Mirex,Lindan, Heptachlor, Hexaclorobenzine (Vijverberg *et al*., 1982). Organophosphates and Carbamates, it is a synthetic insecticide, act on the insect's nervous system, killing or disabling the insect. Organophosphate insecticides such as Sarin, Tabun, Soman and VX, have an accumulative toxic effect to wildlife. Carbamates have shorter duration, less toxic and similar to the others. Other examples are Acephate, Azinphos-methyl, Bensulide, Chlorethoxyfos, Chlorpyrifos, Chlorpyriphos-methyl and Diazinon (Palmer *et al*., 2007).

b. Pyrethroids

It is a natural compound pyrethrum, another class of pesticides and characterized as non-persistent sodium channel modulators and are much less acutely toxic than organophosphate and carbamate usually applied against household pests, such as Allethrin, Bifenthrin, Cyhalothrin, Cypermethrin, Cyfluthrin, Deltamethrin, Fenvalerate, Permethrin, phenothrin, Parallethrin (Wikipedia, 2013; Anderson, 1989; Class *et al*., 2012).

c. Neonicotinoids

Neonicotinoids are synthetic analogues of the natural nicotine insecticides and nicotinic acetylcholine receptor agonists applied as sprays, drenches, seed and soil treatment.They used as alternative to organophosphate and carbamate. The insect treated with Acetamiprid, Clothianidin, Imidacloprid, Nithiazine, Thiacloprid, and Thiamethoxam (Fishel, 2009), exhibited leg tremors, rapid wing motion, disoriented movement, paralysis and death.

d. Ryanoids

Ryanoids is an insecticides extracted from Ryania species (Flacourtiaceae). They block nervous system transmission, bind the calcium ion in both skeleton and cardiac muscles.

e. Biological

Biological insecticides are myrosinase exude substance from plants to prevent insects from eating.This is an enzyme and converts glucosinolates to a variety of compounds. One product of this enzyme is allylisothiocynate, other biological pesticides products based on entomopathogenic fungi (Beaueria bassiana, Metaarthiziumanisopthiae). Another example nematodes such as steinernema feltinae and viruses (e.g., *cydiapomonella graulovirus*) (Rosemary, 1974).

f. Bacterial

Bacterial insecticides are toxin. It produced by *Bacillus thuringiensis* and used as larvicide against caterpillars, beetles and mosquitoes through use of genetic engineering.

g. Plant derived insecticides

Plant derived insecticides are *Anabasine, Annonin, Caffeine, Carapa, Cinamona leaf oil, Tetranor-triterpenoid, Thymol, Linalool, Derris, Neem, Polyketide, Pyrethrum and Guassia* (Sciencedaily, 2008; BBC News, 2010).

Others compounds are not belong to the above groups such as Boric acid, Borax, Borate and Diatomaceousearth.

2. Herbicides

Herbiside is the most commonly used pesticide. They are widely applied to agricultural crops, forest lands, gardens, and lawns. But herbicites are directly applied to lakes and ponds to control nuisance growth of algae (colonial, filamentous and single cells), submersed water grasses (coattail , milfoil , naiad , pondweed), flowering water plants (water lily, spatterdock, duckweed), and emergent water plants (cattails, rushes, reeds). Concerning the effect of this group of pesticides on fish, fish kills occur after herbicide application. Fish die indirectly from suffocation, rather than herbicide poisoning, because masses of rotting water weeds by the herbicide decompose, reducing oxygen levels, such as, Copper sulfate, Fluridone, Sonar, 2-4-D, Glyphosphate, Rodeo, Diquat, Weedtrine, Endothall, Aquathol and Hydrothol. Considerations for application of Herbicides should be considered such as early spring, small weeds, actively growing, less decay, and cool water (Smith, 1987; Ware, 1994).

3. Fungicides

Generally fungicides are not as highly toxic to fish and aquatic animals as insecticides. However, some fungicides have been banned due to their adverse effects

on the environment. Some fungicides are extremely toxic to fish. Some fungicides are poisoned to beneficial soil invertebrates. Their use should be avoided or carefully managed near aquatic systems (Michelle, 2009). Masiá, 2009 stated that, through an extensive sampling in the Llobregat River basin, the presence of 50 currently used pesticides belong to the three commonly used insecticides, herbicides, and fungicides in water, sediment, and biota was assessed. Pesticides detected primarily in water up to 56%, where as their presence in sediments was more intermittent and in biota was scarce. Those at high concentrations in water were the benzimidazoles (carbendazimin 22% of the samples up to 697 ng L^{-1}), the organophosphorus (malathion in 54% of the samples up to 320 ng L^{-1}), and the ureas (diuron in 54% of the samples up to159 ng L^{-1}). This pattern differed in sediments and biota, which were contaminated primarily with organophosphorus (chlorpyrifos 93% of sediments up to 131 ng g^{-1}).

Sources of heavy metals pollution

Heavy metals differ widely in their chemical properties, and are used extensively in electronics, machines and the artifacts of everyday life as well as in high-tech applications. As a result, they are able to enter into the aquatic environment andfood chains of humans and animals from a variety of anthropogenic sources as well as fromnatural sources (Al-Yousuf *et al*., 2000). The main sources ofcontamination include; mining wastes, land fill aches, municipal wastewater, urban runoff,and industrial waste waters particularly fromelectroplating, electronic and metal finishingindustries.

Transport of heavy metals in the environment

The atmosphere represents an active environmental compartment for heavy metals. The other environmental compartments are land surface, ocean, sediments and biosphere. It is known that heavy metals in the atmosphere originate from both natural and anthropogenic sources. Each year large quantities of potentially toxic metals are introduced into the world's ocean from both sources (Mudhoo *et al*., 2007). Human activities also result in the release of large quantities of different contaminants, which are dispersed along various pathways through the biosphere. Bradl, 2005 divided the transport of heavy metals in the marine environment into three parts:

Atmospheric transport

In atmospheric transport, metals are emitted into the atmosphere and are transported by wind over vast distances, depending on their state (gaseous, vapor or particulate). The atmosphere is a major route for the transport of heavy metals to the open oceans (Peterson, 2007).

Biological transport

In biological transport, plankton in coastal areas may have quantitative influence on metal transport. A large numbers of metals may be absorbed by phytoplankton and zooplankton and are brought to the coastal areas via the river systems. Themetals may then settle and become incorporatedin sediments instead of being transported into the oceans(Kazmi *et al*., 2013) .

Aquatic transport

Generally, the greater part of metal load emitted into the environment is transported by water. Most of it eventually reaches lakes and the coastal areas via river transport. Part of the total metal load carried into a lake systems are transported by absorption or adsorption antiparticles of different types. The metals may then be released again into the systems through microbial activity or due to changes in various physical and chemical factors including pH and redox potential (Agenda, 2012). Heavy metals transported into the marine environment may be incorporated into the marine food chain and eventually reach human consumers (WHO, 2012).

Effect of heavy metals on human health and fish

Fish is important for a healthy diet because they are rich in essential nutrients. However, when fish tissues accumulate metals in various concentrations, and when that exceeds the safety levels, the toxic metals reach the human body and cause various forms of diseases. For this reason, fish consumption could become a major pathway to metal exposure and consequent risk for human health (Sunde *et al*., 2000). Heavy metals such as cadmium, mercury, lead and arsenic pose a number of hazards to humans, these metals are also potent carcinogenic and mutagenic (Ahmad *et al*., 2009). Heavy metal toxicity can result in damage or reduced mental and central nervous system function, lower energy levels and damage to blood composition, lungs, kidneys, liver another vital organs. Long term exposure may result in slowly progressing physical, muscular and Alzheimer's disease, Parkinson's disease,muscular dystrophy, and multiple sclerosis. According to Ferner (2001), heavy metal toxicity is a chemically significant condition when it does occur.

Essential heavy metals

Zinc

Zinc is a second most abundant element in humans after iron. It appears in enzymes and maintains cytoplasmic integrity.

There is a significant role in central nervous system. Its toxicity includes photoxicity, anemia, lack of muscular coordination, decreased sense of smell, taste, loss of appetite, delayed wound healing, skin sore and abdominal pain. It damage pancreas, altered protein metabolism and respiratory disorders. Zinc affects the growth and survival of fish. Accumulation of Zn takes place in the gills. Hampering respiration and resulting in hypoxia and further death. Loss of balance due to reduced motility of fins and vigorous swimming.

Iron

Iron plays a key role in many biochemical reactions.Iron in animal body is organic in nature. A small percentage is found as free inorganic ions. Haemoglobin (blood) represents approximately 60% of total body iron, whereas myoglobin represents only about 3-7% of total iron. There are two kinds of organic iron: haemal and non-haemal. Haemal iron represents 70-75% of total iron and includes haemoglobin, myoglobin, cytochromes, catalase and peroxidase. Non-haemal iron includes iron transport and storage forms such as transferrin, ferritin, haemosiderin, and other iron proteinates. Iron content differs with respect to species, sex, age, state of health, nutrition. Chronic high levels of iron causes a liver disease named hemosiderosis.

Nickel

Nickel and its salts are used in several industrial applications such as in electroplating, automobile and aircraft parts, batteries, coins, spark plugs, cosmetics and stainless steel and is used extensively in the production of nickel-cadmium batteries on an industrial scale. It enters into the water body naturally by weathering of rocks and soils and through the leaching of minerals. The water-soluble salts of nickel are the major problems of contamination in aquatic systems. Paint formulation and enameling industries discharges nickel containing effluents to the nearby water bodies. Nickel is also found in cigarettes as a volatile compound commonly known as nickel carbonyl (Wasim *et al*., 2009).

Nickel required for the development of body. Consumption in lower and higher quantities can lead to deficiency and toxicity respectively.

Toxicity lead to phototoxicity, eczema of hands, contact dermatitis and higher doses lead to DNA damage. It damage heart and liver area (Pandey and Madhuri, 2014). Nickel compounds are a potent source of cancer in humans.This heavy metal leads to acute or chronic poisoning and eventually death of the fish.

Cobalt

Cobalt is an essential component of vitamin B_{12} (Underwood and Filmer, 1935).Vitamin B_{12}, also known as cobalmine contains about 4.5% cobalt. Cobalt deficiency leads to "wasting diseases" and results inadequate synthesis of vitamin B_{12} from dietary cobalt. Low conversion rate explains by rapid cobalt uptake by rumen micro-organisms (McDowell, 1992).

Cobalt distributes throughout the body with high concentrations in liver, bone and kidney (Underwood and Suttle, 1999). Cobalt toxicity precipitates hypothyroidism. It results in pericardial effusion, congestive cardiac failure, hemoglobinemia, fibrosis of pulmonary interstitium and allergic reactions (Donald, 1999).

Copper

Copper is an essential mineral for all living organisms. Copper deficiency effects on numerous organs like liver and tissues, cardiovascular system and central nervous system. Copper is an essential component of metalloenzymes

Copper deficiency results anaemia and manifested dietary iron.Copper toxicity causes kidney and liver damage. Metabolic functions of copper serve of copper bioavailability in fish.Copper toxicity causes respiratory inhibition by affecting oxygen consumption (Underwood and Suttle, 1999).

Manganese

Manganese is an abundant trace element in all livestock tissues. The mineral forms a link in the chain of calcium metabolism. Insufficient manganese impairs the cartilage development and causes skeletal disorders. It has an important function in blood clotting and lipid and carbohydrate metabolism. It is very important for the protection of cells against damage by the free oxygen radical O_2. Abnormal male and female reproductive functions are also related with a lack of sufficient manganese.

Arsenic

Arsenic is found naturally in the deposits of earth's crust worldwide. The word"arsenic" is taken from Zarnikh in Persian literature, which means yellow pigment (Mudhoo *et al*., 2001). It enters the environment through the natural weathering of rocks and anthropogenic activities, mining and smelting processes, pesticide use and coal combustion. The toxicity of arsenic as a result of the contamination of ground water bodies and surface waters is of great concern. Metal oxides of Fe, Al, and Mn play a role adsorption of arsenic in aquatic bodies.

Non-essential heavy metal

Lead

Lead is a heavy metal necessary for the growth of human body. It enters the body by respiration and

Flow Chat: Figures 1 and 2 show the entry of pesticide and heavy metal in living organism.

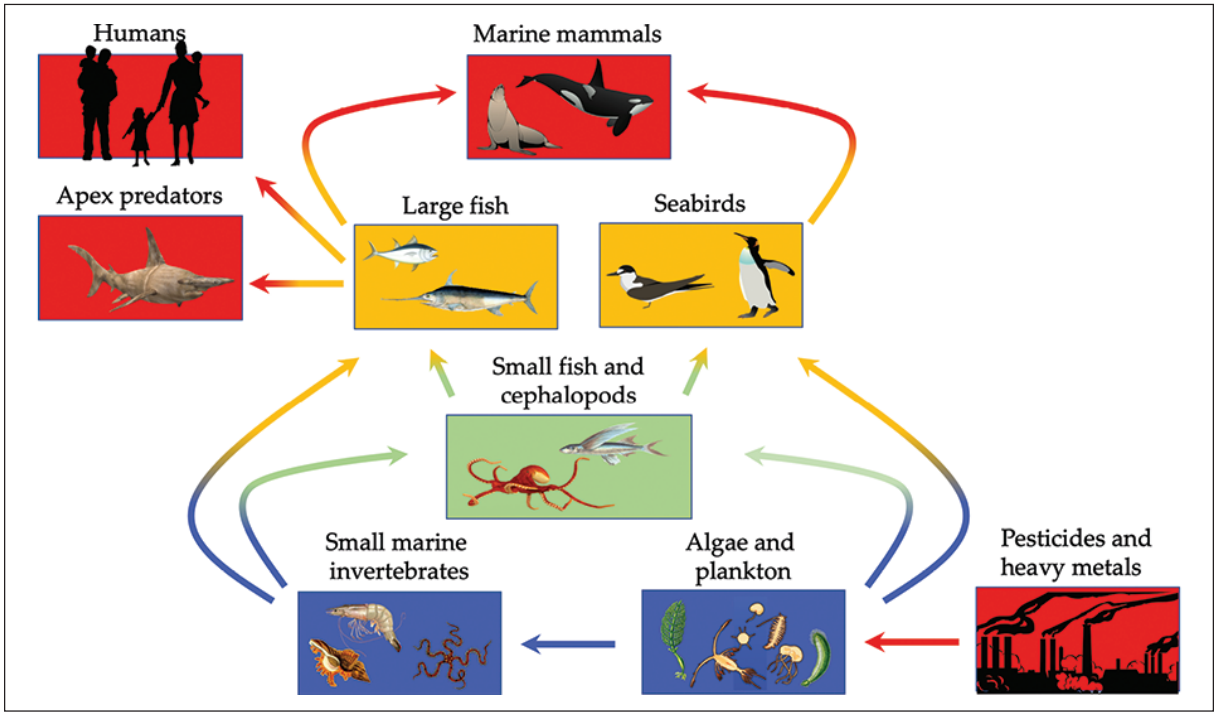

Fig.1: Mechanism of entry of metals in living organism(Ali &Khan, 2019).

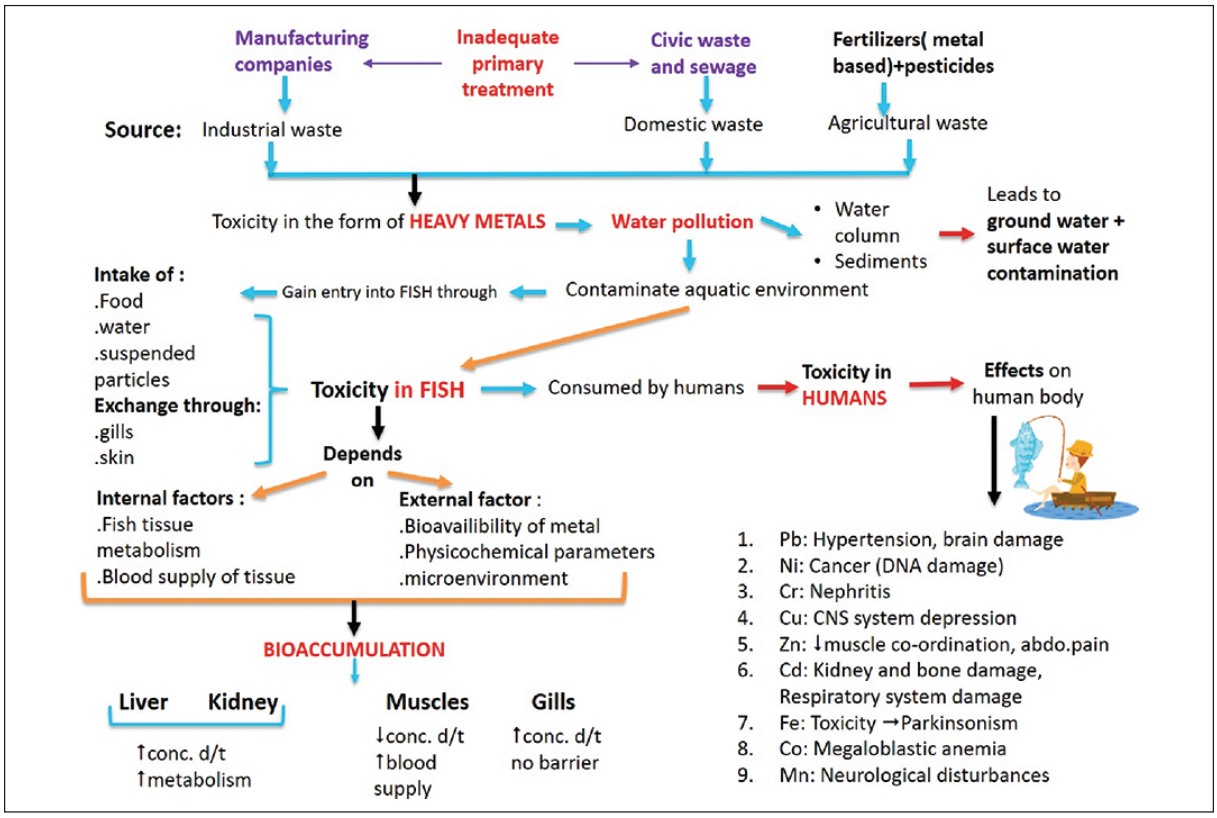

Fig. 2: Schematic representation of water pollution, fish toxicity and its hazardous effects on humans due to heavy metals.

ingestion. Significant quantities accumulate in the bones, muscles, blood and fats.

Lead damage in the form of liver, kidney, brain damage and nervous impairment of human body..

It reduced reproduction and osteoporosis is the other side effects. It causes brain toxicity, mental retardation, learning defects, growth retardation and serious health effects in children, phototoxicity and hypertension.

Effects of lead are in the form of hematological and nervous changes in fish. Toxic levels of Pb in fish can lead to toxicity in humans. (Kalay M *et al.*,1999).

Chromium

Source of chromium is leather tanning industries, textile mills, steel and electroplating setups. Every year 50,000 tons of chromium is emitted in the form of combustion and refuse burning (Merian, 1984). Fertilizers contain significant amounts of chromium. Chromiumenters are into the environment by natural inputs and anthropogenic sources. Volcanic eruptions geological weathering of rocks, soils and sediments are the natural sources of chromium whereas, anthropogenic contributions of chromium come from the burning of fossil fuels, production of chromates, plastic manufacturing, electroplating of metals and extensive use in leather and tannery industries (Mohan *et al.*, 2006).

The main causes of rising level of chromium in water and fish due to release of industrial effluent reflect. There is a toxic effect in the form of allergic reactions, skin irritation and ulceration. Chronic exposure leads to internal organ damage in human body i.e kidney as well as liver damage, alteration in nervous system, reduced immunity (Lenntech, 2012). Accumulation of heavy metals takes place through ingestion or from surrounding water. Chromium leads to toxicity in the form of anemia, lymphocytosis and eosinophilia in fish body. High concentrations of chromium damage of gills.

Cadmium

Cadmium is a non-essential element along with mercury and arsenic and is highly toxic of large water pollution. Major quantity of cadmium is liberated due to municipal waste and burning of fossils. Recently industrial and domestic waste dumping in water bodies elevated cadmium levels (Nriagu and Pacyna, 1988). It can be introduced into the environment by metal-ore refining, cadmium containing pigments, alloys and electronic compounds, cadmium containing phosphate fertilizers, detergents, and refined petroleum products. Rechargeable batteries with nickel-cadmium compounds are also sources of cadmium (Dojlido and Best, 1993).

Cadmium leads to toxicity in the form of diarrhea, infertility, cancer, cardiac abnormalities, bronchiectasis, emphysema and osteoporosis in human body (Lenntech, 2012). Rate of reproduction in fish species is affected and can eventuate as extinction of their species (Sridhara *et al.*, 2008). Kidneys are damaged, tumors, hypertension, hepatic dysfunction are also observed in fish body (Mansour and Sidky, 2002).

Mechanism of entry of heavy metals

Entry into living organisms through abiotic factors: Soil, Sediment and Water

Soil

Heavy metals are a part of fertilizers, when it is applied into the agricultural soil and ground water.Consumption of this water leads to precipitation of heavy metal in to human body. Heavy metals gain entry into the soil in the form of automobile induced pollution.

Sediments

Sediments act as the source and reservoir of heavy metal.Pooling of heavy metal takes in the sediments by releasing into water. Constant settling of heavy metals in sediments tends to percolate into the ground water further contaminating them. Heavy metals in sediments are contributed by many physicochemical factors like organic matter, temperature, particle size, microbes, redox reactions and salinity.

Water

Ground water contamination or consumption of fish a portal of entry into the human body.

Pollutants gain access into the fish body through 5 ways:

1) Intake of contaminated food, 2) Suspended particles, 3) Water intake,4) Through gills occurs exchange of ions, 5) Exchange through skin (Qadir and Riffat, 2011).

CONCLUSION

The long-term exposure of fish to pesticides is a continuous health hazards for the human population. So, human population is at high risk by consuming thistoxicity fishes. The rationalization uses of pesticides considered the main factor in reducing aquatic environmental pollution with pesticides and other contaminants. A necessary precaution is required during the application of pesticides to protect of wildlife and water quality. If pesticides used in combination with other pest control measure, and applied safely, the pollution of surface waters and contamination of aquatic life can be avoided. Pesticides are more experimental work to determine the concentration and time of exposure that don't induce significant sub lethal effects onfish. Measures should be necessary to mitigate the

effects of metal toxicants on human health and aquatic environment. Regular assessment and monitoring of concentrations of heavy metals are needed and a regular survey is also needed regarding daily consumption of water and fish food. Rules and regulations regarding primary treatment of waste products should be strictly completed and surveillance should be ensured by industries and municipalities.Scientific research should be also enhanced to promote assessment of toxic heavy metals.Considering the risks of heavy metal toxicity, measures should be taken to reduce the levels of heavy metals in water, fish and humans and to mitigate the health risks associated with it.Environmental laws should be enforced to ensure that the aquatic environments are protected from exposure to toxic substances and from the risk associated with the use of chemicals.

REFERENCES

Ackman, R.G., McLeod C., Rakshit S. and Misra K.K. 2012. Lipids and Fatty Acids of Five Fresh WaterFood Fishes of India. *J. Food Lipids*,**9**: 127-145.

Ahmad, S.M., Yusafzai, F. and Bari, T. 2014. Assessment of heavy metals in surface water of River Panjkora Dir Lower, KPK Pakistan. *J. Biol. Environ. Sci.,* **5**:144-152.

Ali, H. and Khan, E. 2018. Trophic transfer, bioaccumulation and biomagnification of non-essential hazardous heavy metals and metalloids in food chains/webs: Concepts and implications for wildlife and human health. *Human Ecol. Risk Assess.*: An International Journal. **24**(6):1353-1376.

Al-yousuf, M.H., El-shahawi, M.S. and Al-ghais, S.M. 2000. Trace Metals in Liver, Skin and Muscle ofLethrinus lentjan Fish Species in Relation toBody Length and Sex. *J. Sci. TotalEnviron*., **14**(7): 247-256.

Anderson, R.L. 1989.Toxicity of synthetic pyrethroids to freshwater invertebrates. *Environ. Toxicol. Chem*., **8**: 403-410.

Arjmandi, R., Tavakol, M. and Shayeghi, M. 2010. "Determination of organophosphorus insecticides residues in the rice paddies", *Int. J. Environ. Sci. Tech.*, **7**(1): 175-182.

Banaee, M. 2013. "Physiological dysfunction in fish after insecticides exposure" INTECH-chapter 4.

BBC News. 2010. "Almond farmers seek healthy bees", Retrieved, 01-05,2010.

Banaee, M., Mirvagefei, A.R., Ahmadi, K. and Ashori, R. 2009. "The effect of Diazinon on histopathological changes of tests and ovaries of Common caro (*Cyprinus carpio*)", Scientific J. Marine Biol.,**1**(2):25-35.

Bradl, H.B. 2005. Heavy metals in the environment: Origin, interaction and remediation. *J. Sci. Technol*., **6**: 76-84.

Buck, D. 1993. "Aquatic pollution: effects on the health of fish and shellfish", *Parasitology*, **106**:29-37

Class, T., Thomas, J. and Kintrup, J. 2012. "Pyrethroids as household insecticides: analysis, indoor exposure and persistence", *J Analytical Chem*., **340**: 4-2.

David, W.C., Richard, C., Steven, J., Gaydos, J.G. and William, W.C. 2009. "Aquaculture Environmental Toxicological, and Health tissues", *Int. J. Hyg. Environ Health*, **212**:369-377.

Donald, G., Barceloux, and Donald, B. 1999. Copper. Journal of Toxicology: Clinical Toxicology, Volume 37, Issue 2, Pages 217-230.

Dojlido, J. 1993. Best GA. Chemistry of Water andWater Pollution. Chichester: Ellis Horwood Publishers; 1993.

Dutta, H.M. and Meijer, H.J.M. 2003. "Sub-lethal effects of Diazinon on the structure of the testis of bluegill. lepomis macrochirus : a microscopic analysis", *Environ. Pollut*., **125**(3): 355-360.

Ewing, R.D. 1999. "Diminishing returns: Salmon decline and pesticides", Funded by the orgon pesticide education network, Biotech Res. Consulting, INC., Corvallis, OR.55.

Ferner, D.J. 2001. Toxicity: Heavy metals. *Medical Journal*. **5**: 99-101.

Fishel, F.M. 2009. "Pesticide Toxicity Profile: Neonictinoid Pesticides IFAS" publication, PI-80.

Kazmi, A.A., Akansha, B., Shaida, A., Sharma, M., Starkl, M. and Trivedi, R.C. 2013. A short screening study on water quality of Indian rivers and lakes. IWRS, Volume 33, No.3

Kalay, M., Ay, O. and Canli, M. 1999. Heavy metal concentrations infish tissues from the Northeast Mediterrenean Sea. *Bull. Environ. Contamination Toxicol*., **63**: 673–681.

Kings, P.D. and Kreutzweiser, D.P. 1980. "Environmental impact assessment of a semioperational permethrin application", foresty service report FMP-X-30, Environment Canada, Ottauh, and PP.1-47.

Lenntech, B.V. 2012. Heavy Metals. www.lenntech.co./periodic.periodicchart. htm.

Louis, A.H. and Diana, L.W. 2013. "Pesticides and Aquatic animals: A Guide to reducing impacts on aquatic systems", Virgina Cooperative Extension, VSO, 420-013.

Mansour, S.A and Sidky, M.M. 2002. Ecotoxicological Studies, 3 Heavy metals contaminating water and fish fromFayoum Governorate, Egypt. *J. Food Chem.*, **78**(1): 15-22.

Masiá, A., J. Campo, A. Navarro-Ortega, D. Barceló and Y. Picó. 2015. "Pesticide monitoring in the basin of Llobregat River (Catalonia, Spain) and comparison with historical data", *Sci. Total Environ*., 503–504, 58–68.

McDowell, L.R. 1992. Iron. In: Minerals in Animal and Human Nutrition. Academic Press, San Diego, CA, USA, p. 152-175.

Merian, E. 1984. Introduction on environmental chemistry and global cycles of chromium, nickel, cobalt beryllium, arsenic, cadmium and selenium, and their derivatives. *Toxicol. Environ. Chem*., **8** (1): 9–38.

Michelle, D. 2009. "Research Associated, fisheries and wildlife", Virginia cooperative extension Virginia Experiment Station.

Mohan, D., Singh, K.P. and Singh, V.K. 2006. Hazard matter: *Environ. J*., **17**(8):280-353.

Mudhoo, A., Sharma, S.K., Garg, V.K. and Tseng, C.H. 2001. Critical Review: Environmental Technology.London: CRC Press; 2001.

Nriagu, J.O. and Pacyna, J.M. 1988. Quantitative assessment of worldwide contamination of air, water and soils by trace metals. *Nature*, **333**:134–139.

Palmer , W.E., Bromley, P.T. and Brandenburg, R.L. 2007. "Wildlife and Pesticides–Peanuts", North Carolina Cooperative Extension Service. Retrieved on 14 October2007.

Pandey, G. and Madhuri, S. 2014. Heavy Metals Causing Toxicity in Animals and Fishes: Research Journal of Animal, Veterinary and Fishery Sciences, **2**(2):17-23.

Peterson, S.A., Vansickle, J., Herlihy, A.T. and Hughes, R.M. 2007. Mercury concentration in fish frim streamsand rivers throughout the Western UnitedStates. *Environ. Sci. Technol*., **41**: 58-67.

Qadir, A. and Riffat, N. M. 2011. Heavy metals in eight edible fish species from two polluted tributaries (Aik and Palkhu) of the River Chenab, *Pak. Biol. Trace Element Res*., **143**:1524-1540

Rosemary, A.C. 1976. "Isothiocynates, nitriles and thiocynates as products of autolysis of glucosinolates un ceucifera", *Phytochem.* , **15**:759-762.

Science daily. 2008b., "Cinamon oil kills mosquitoes" Retrieved 5 August.

Shankar, K.M. and Kiran, B.R., Venkateshwarlu, M. 2013. "A review on toxicity of pesticides in fish", *Int. J.Open Scientific Res*., **1**(1):5-36.

Smith, G.J. 1987. "Pesticide use and Toxicology in relation to wildlife .Organophosphorous and carbamates compounds", USDI fish and Wildlife service Resource publication 170, Washington DC,1987.

Sridhara, C.N., Kamala, C., Samuel, S. and Raj, D. 2008. Assessing risk of heavy metals from consuming food grown onsewage irrigated soils and food chain transfer. *Ecotoxicol. Environ. Safety*, **69**:513-524.

Spradley, J.P. 1985. "Toxicity of pesticides to fish", Arkansas cooperative extension service, Publication MP330, University of Arkansa little Rock, Arkansas,1985.

Sunde, R.A. 2000. Dietary reference intakes: Vitamin C, vitamin E, selenium, and carotenoids.Washington DC: National Academic Press; 2000.

Underwood, E.J. and Filmer, J.F. 1985. The determination of the biologically potent element (cobalt) in limonite. *Aus. Veteri. J*., **11**: 84-92.

Underwood, E.J.and Suttle, N.F. 1999. The mineral nutrition of livestock. CABI Publishing, Wallingford UK.

Ware, GW.1994. "The pesticide Book", Thompsson Publications.

Wasim, MD, Dwaipayan, S. and Ashim, C. 2009. "Impact of pesticides use in Agriculture: their benefits and hazards", Interdiscip. *Toxicol.*, **2**(1):1-12.

WHO. 2012. Cadmium: Guidelines for DrinkingWater Quality. 3rd Edition Incorporating 1st and2nd Agenda. Geneva: World Health Organization.

Wikipedia. 2013.The free encyclopedia, "Insecticide Dropdata", 1-5.