THE EFFECT OF ENVIRONMENTAL AGENTS & CHEMICAL'S ON HUMAN AND ANIMAL HEALTH: A REVIEW

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Abstract:- Chemicals and environmental agents can have significant impact on human as well as animal health Contact to toxic substances such as heavy metals, industrial pollutants, pesticides, etc can lead to a range of health issues. In humans long term exposure to harmful chemicals can cause hormonal disturb, weaken the immune system and increase the risk of chronic diseases. In animals, pollutants in air, water, food and soil sources can cause genetic mutations, various changes and also population decline, which affect the entire ecosystem. regulation, safety testing and sustainable practiced are important to mitigate these problems. Public awareness, responsible chemical management play a crucial role in reducing harmful exposures and protecting both animal as well as human health.

Key Word:- soil pollution, air pollution, water pollution, Organophosphate, Neonicotinoids.

Environmental Agents:-

A variety of materials and elements that have the potential to impact both the environment and human health are known as environmental agents. these agents fall into a number of categories such as physical agents, chemicals and biological entities/ agents. In order to manage ecological systems and safe guard public health. It is essential to understand environmental agents.Environmental agents are compounds, physical elements or living things that come from the environment and have ability to injure to living things.

Chemical Agent	Biological Agent	Physical Agent
Pollutants :- **Water Contaminants:** Heavy metals like Ag, Lead, Arscenic. & Pesticides, Herbicides **Air Pollutants:** Particulate matter, Nitrogen Oxide, Sulfur Dioxide, Pesticides and Herbicides **Industrial Chemicals:** PCBs, Dioxins	**A] Pathogens:-** **1) Bacteria** (Eg:- Salmonella, E.coli) **2)Viruses** (Eg:- Rabies) **3) Parasites** (Eg:- Giardia, Toxoplasma) **B]Allergens:-** Pollen., Mold Spores, Dust Mites.	a) Radiation (Eg:- Uv Radiation) b) Noise Pollution. c) Air Pollution.

Soil Pollution:-

Soil is the top layer of the earths crust, made up of a mix of solid, liquid, and gas substances, including both living and non living materials. This includes mineral particles, decomposing organic matter. Microbes as well as H2O & air found in the spaces between soil particles. The process of soil formation is very gradual, beginning with weathering which breaks down into mineral particles & continuing through soil development known as pedogenesis. This involves changes in mineral matter due to interactions among biological topographic and climatic conditions. It can take anywhere from 200 to several thousands years to create just one inch of top soil.

Therefore soil is a vital natural resource that has developed over centuries, supporting a wide range of plants and providing habitats for various life forms, both microscopic & macroscopic.

The components of soil includes:-

- ✓ Organic mineral matters:- 45%
- ✓ Organic matter:- 5%
- ✓ Soil water :- 25%
- ✓ Soil air :- 25%

Soil pollution occurs when the soil becomes contaminated with harmful substances, toxic chemicals or other pollutants in amounts that degrade its quality and make it unihabitable for organisms like insects and microbes.

This can also be described as the introduction of chemicals into the soil in quantities that are harmful to environment and its inhabitatns. Human activities such as mining, modern agricultural practices, deforestation, careless disposal of waste and improper handling of industrial waste are main causes of soil pollution.

Causes Of Soil Pollution:-

1] Industrial and Mining Activities:-

The rise of various industries since the start of industrial era, without effective waste management system is a major factor in soil pollution.

2] Modern Agricultural practices:-

In recent decades to boost food production on limited lands due to growing population, there has been a wide use of synthetic pesticides. There has been a wide use of synthetic pesticides and fertilizers. This has led to soil toxicity as these chemicals reach into the ground when mixed with water and gradually diminishing soil natural composition and making it more susceptible from wind and water. Additionally plants take in many of these pesticides.

3] Lack of proper waste disposal:-

Our modern lifestyles whether in cities or rural areas, generate a significant amount of waste and the absence of effective waste management causes the soil pollution. Urban waste includes dried sludge, sevage, garbage, plastics, glass, metal cans, fibers, paper, rubber, street debris, leaves, containers, abandoned vehicles and other discarded items. Non-Biodegradable materials like plastic are particularly includes.

4] Radioactive Pollutants:-

Soil pollution is also caused by radioactive materials from nuclear testing fallout and industries that produce nuclear dust and waste. For instance, nuclear reactors generate waste containing isotops like R-Uthenium-

106,Iodine-131,Barium-140,Cesium-144 and Lanthanum-140 with primary isotopes like Strontium-90 which has a half life of 28 years and Cesium-137 with a half life of 30 years.

Rainwater can cary those isotopes into the soil, where they bond with soil particles through electrostatic forces. The radioactive isotopes in the soil emit gamma radiation.

5] Biological Agents:-

Soil pollution is also significantly impacted by the presence of human, animal and bird waste which serves as major source of biological contaminants.

Eg:- The heavy use of manures and digested organic materials contributed to the soil pollution.

How it affect on human beings:-

Soil plays a important role in influencing human health by both positively and negatively. Healthy soil supply the essential nutrients and clean water to plants used in the production of nutritious food. Here is a growing awareness among individuals regarding the impact of their dietary choices on overall health. The focus remains on the final stage of food processing, neglecting the importances of soil health, which is viral or important for the 95% of food. Soils lacking in nutrients lead to plants hat are deficient in macro and micro nutrients resulting in nutritional deficiencies that can severely affect the growth and survival of children.

Healthy soils are a source of various antibiotic compounds and other chemicals essential for the production of medicines and vaccines.Soil pollution represents a significants environmental essue due to its associated health risks for instances being exposed to soil high level of benzene can developing leukemia.

It is important to recognize all soils inherently contain compounds that can be harmful or toxic to humans and other living organisms. The levels of these substance are typically low enough to avoid posing a threat to the ecosystem.

Type of soils:- There are mainly 6 types of soils.

1) Peaty soil
2) Loamy soil
3) Sandy soil
4) Chalky soil
5) Clay soil
6) Silty soil

Water Pollution:-

Intro:- water has chemical formula H2O, making it an inorganic compound. It is a transculent compound that has no taste, no odour and is almost colourless. It serves as a solvent in the fluids of all known living things and is the primary component of the hydrosphere on earth.

Even thought it doesn't provide organic micronutrients or dietary energy, it is essential for all known forms of life. According to its chemical formula H2O each of its molecules is made up of two hydrogen atoms and one oxygen atom joint by covalent bond.The angle at which the hydrogen and oxygen atoms are joined is 104.45`.

Water pollution:-

Water polluting of lakes, rivers, aquifers, groundwater, seas and oceans is known as water pollution.Usually human activities is to blame for this changes in the physical, chemical or biological characteristics of water that may negatively affect any living thing are known as water pollution.Water pollution is suitable for human and animal consumption is referred to as drinking water.

Causes of water pollution:-

1. Sewage [food waste,detergent,micro-organism].
2. Industrial waste.
3. Dumping of solid waste.
4. Radioactive waste.
5. Excessive use of fertilizers and pesticides is agriculture.
6. Contamination of water bodies with toxic metals.

Effect of water pollution:-

- Water is common solvent and a key cause of illness 80% of infectious disease are water borne according to the WHO.
- Many nations drinking water does not adhere to WHO standards 3% of fatalities are brought on by dirty low quality water.
- In developing nations, untreated sewage contaminated drinking water resulting in water pollution which kills about 14000 people every day.

Effect of water pollution on human:-

The following are some detrimental effects of contaminated water on human health.

BACTERIAL DISEASES.

Sr.No	Disease	Causative Agent	Source	Symptoms
1	Typhoid fever	Salmonella typhi	Contaminate water	High fever, diarrhea, hepatomegaly.
2	Salmonellosis	Genus salmonella	Drinking Contaminate water	Fever.abdominal cramps, diarrhea
3	Cholera	Vibrio cholerae	Drinking water with bacteria	Nausea, cramps, watery diarrhea, vomiting
4	dysentry	Shigella	Water contaminate with bacteria	Fever, vomiting, abdominal cramp

Viral Diseases:-

Sr.No	Disease	Causative Agent	Source	Symptoms
1	Hepatitis-A	Hepatitis-A virus	Contaminated water	Fever, fatigue,abdominal pain,nausea,diarrhea,weight loss
2	Poliomyelitis	Polio virus	Through the feces of infected individuals	90-95% pt.have no symptoms.4-8% headache,fever, etc1% pt.paralytic.

Protozoal disease:-

Sr.no	disease	Causative agent	source	symptoms
1	Amoebiasis	Entamoeba histolytica	Contaminated water	Fever, fatigue, diarrhea, abd.discomfort.
2	cyclosporiasis	Cyclospora cayetanensis	Contaminated water	Cramp,nausea, vomiting, muscle ache, fever and fatigue.

Effect of metals:-

Sr.no	element	source	effects
1	Lead	Mining,plumbing industry.	Kidney disease,anemia,colic pain,nerve disease
2	Mercury	Industrial waste, paint,pesticides.	Diarrhea,gingivitis,anemia
3	zinc	Industrial waste.	Abnormal cramp, vomiting,diarrhea

Air Pollution:-

Air pollution can harms us when it accumulates within the air in excessive sufficient concentrations. Thousand of citizens live in areas where particle pollution and toxic pollutants causes serious health issues like inflammation of eyes, nose and throat wheezing, coughing, chest tightness and respiration difficulties lung and heart issues such as asthma, heart attack, air pollutants can harm to the immune neurological, reproductive and respiratory structures.

Causes of air pollution:-

The various sources or causes are as follows,

Industrial pollutants	Radiations
Automobiles	Suspended particulate matters {SPM}
Burning fuels	Emission from vehicles
Agricultural activities	Deforestations
Natural contaminants {fungi, spores, cysts, bacteria, methane, etc.}	

Air pollutants:-

Following are the air pollutants.

- Particles: dust,smoke,fly ash.
- Carbon monoxide.
- Ammonia.
- Sulphur dioxide.
- Nitrogen oxide.
- Hydrocarbons
- Aldehydes
- Radiations.
- Cyanides.

Air pollution classified into two types:-

1) primary air pollution **2) secondary air pollution**

Effects of air pollution:-

Sr.no	pollutants	source	Pathological effect
1	Aldehydes	Thermal decomposition of fats, oil and glycerol.	Irritate nasal and respiratory tracts
2	Ammonia	Chemicals processes, dry making, explosive fertilizer.	Inflames upper respiratory passage
3	Arsine	Processes involving, dry metals or acids containing arsenic soldering.	Breaks down red cells in blood, damages kidney and causes jaundice.
4	Carbondioxide	Gasoline motor exhausts, burning of coal	Reduces oxygen carrying capacity of blood
5	Chlorine	Bleaching cotton and flour, many other chemical processes.	Attacks entire respiratory tracts and mucous membranes of eyes.
6	Hydrogen cyanide	Fumigation, blast furnaces, chemical manufacturing, metal plating.	Interferes with nerve cells, produces dry throat, indistinct vision and headache.
7	Sulphur dioxide	Coal and oil combustion	Causes chest constriction, headache, vomiting.
8	Suspended particles	Manufacturing units	Causes emphysema, eye irritation and possibly cancer.

Heavy metals:-Pb, Hg and Cd:-

Heavy metals like lead, mercury and cadmium are harmful to human health. Despite being naturally present individual activity and modernization have increased the prevalence of certain metals in the environment. Numerous health problems can arise from exposure to these metals through tainted food, water or air.

General health effects of heavy metals:-

1) **Neurological conditions:-** heavy metals can lead to the neurological harm,resulting in diseases such as Alzheimers,Parkinsons and multiple sclerosis.
2) **Organ harm:-** exposure can cause damage to the kidneys,liver issues and respiratory complications.
3) **Cancer threat:-** metals such as cadmium and arsenic are recognized as cancer causing agents,heightening the likelihood of developing cancer.
4) **Reproductive problems:-** exposure to cadmium during pregnancy may result in lower birth weights and premature deliveries.

Special health effects of heavy metals:-

- **Lead(pb):-**

a) **Neurological effect:-** exposure to lead can result in injuries to the CNS resulting in cognitive deficits and neurological conditions. It raises inflammatory cytokines in the CNS, which can hinder brain development and function.

b) **Respiratory and cardiovascular effect:-** the exposure to lead is associated with respiratory and cardiovascular problems due to its influence on immune response and oxidative stress.
c) **Kidney damage:-** lead has the potential to cause kidney dysfunction and failure, particularly at elevated levels of exposure.

➢ **Mercury (Hg) :-**

a) **Neurological damage:-** Mercury is recognized for its neurotoxic effects, resulting in CNS injuries and imparing cognitive abilities.it attaches to thiol groups,disrupting enzyme function and glutathione metabolism.
b) **Renal and hepatic toxicity:-** Exposure to mercury can lead to kidney impairment and liver toxicity. Negatively impacting liver function and resulting in gastrointestinal ulcers.
c) **Developmental concerns:-** Elevated levels of mercury exposure are linked to congenital anomalies and delays in development.

➢ **Cadmium (cd) :-**

a) **Bone and kidney disorders:-** Cadmium contributes to degenerative bone conditions (such as osteoporosis) and impairs kidney function. It disrupts calcium regulation and triggers cell death in renal cells.
b) **Cancer :-** Cadmium is recognized as a carcinogen, heightening the risk of various cancers by interfering with DNA synthesis and repair processes.
c) **Liver and lung harm:-** Exposure to cadmium can lead to hepatic injury and lung damage, further complication and health effects.

Neonicotinoids:-

- Scientists at shell and bayer created a class of neuroactive insecticides called neonic in 1980.
- They share chemical similarities with nicotine.
- It is used as insecticide most frequently employed to protect crop.
- It also used extensively in veterinary medicine, to control fleas and ticks.

Primary routes of human exposure to Neonicotinoids :-

Human Can Be Exposed To Neonicotinoids Through.

1) Dust and pollen inhalation.
2) Food consumption.
3) Drinking polluted water.
4) Ingestion of dirt.

*Why neonicotinoids becoming a bigger health risk and exposure problem for human ?

Neonicotinoids Have Negative Effect On Human Health Which Include:-

a) Oxidative stress.
b) Metabolic alternations.
c) Liver cancer.
d) Erythema.
e) neurological symptoms.
f) nausea and vomiting.
g) Red eye.

The majority of NEO'S are eliminated from body but some metabolits can build up and interfere with insulin and glucose homeostasis, testosterone level and quantity of semen.

How neonicotinoids affect the environment:-

1) **Contamination of water and soil:-** Neonicotinoids can contaminate both terrestrial and aquatic ecosystem by gerunding in the soil and seeping into rivers when they are administered directly to crop or as seed treatments.
2) **Pollinator impact:-** Neonicotinoids are harmful to pollinators like bees they may impair their capacity to forage, navigate and breed. It ↓se the colony and have effect on food production.
3) **Effect on aquatic life:-** It have the potential to pollute surface water, harm fish and aquatic invertebrates and upset the equilibrium of ecosystem and food chain.

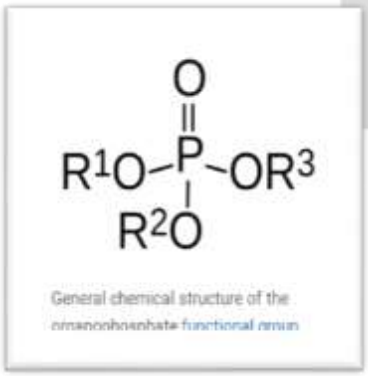
Organophosphates:-

- Organophosphates are the compound formed by the esterification process between phosphoric acid and alcohol.
- When organophosphate compounds introduced into the body it inhibits enzyme acetylcholinesterase (ACHE), resulting in the neurotransmitter acetylcholine, which results in effects on nicotinic and muscarinic receptors also on the CNS (central nervous system).
- Bronchorrhea and bronchospasm is the leading causes of death in causes of Organophosphate poisoing.
- Antidotal therapy and comprehensive support are necessary for the proper t/t of Organophosphate toxicity.

History of Organophosphates use:-

- The first ***Organophosphate insecticide was introduced in the 1800*** but it widespread after world war2.
- In the march 2018, the poisoning of ***sergi and Yulia Skripal*** took place in England, the compound used in this poisoning was the Organophosphate agent called as ***Novichok.***

Chemical structure of Organophosphate:-



General chemical structure of the organophosphate functional group

Clinical manifestations:-

- Muscle weakness.
- Fatigue.
- Muscle cramps.
- Fasciculation.
- Paralysis.
- Memory loss.
- Breathing difficulty.
- Headache.
- Emotional changes.

- Seizures.
- Sweating.
- Confusion.

Complications:-

a) Respiratory Symptoms:-

1) Accumulation of fluid around lungs.
2) Bronchospasm.
3) Respiratory failure.

b) Cardiovascular systems:-

1) Angina pectoris
2) Hypo/ hepertension.

c) Nervous system:-

1) Parkinsonism.
2) Neuropathy.
3) Hallucinations.
4) Seizures.

Causes and risk factors:-

Organophosphate poisoning can occurs if a person is in contact with chemicals in large doses or over a long time.

The risk of Organophosphate poisoning higher in,

- Agricultural an rural settings.
- Homes and gardens.
- Veterinary practices.

Organophosphates may also be present in food items due to spraying on crops.

Diagnosis:-

1) Clinical history and exposure assessment:-

- It can be diagnosed based on clinical history, symptoms and lab tests.
- Route of exposure.

2) Symptoms and physical examination:-

Salivation, lacrimation, urination, diarrhea, etc in case of acute muscarinic symptoms.
Muscle twitching, weakness, paralysis, respiratory failure in case of nicotinic symptoms.

3) Confirmatory testing :-

Atropine challenge test in perform, if uncertain administering a small dose of atropine which results in lack of response, suggests organophosphate poisoning.

Conclusion :-

There are numerous and intricate ways that chemicals and environmental factors affect the health of human and animal.

There are various chemicals like organophosphate, lead, mercury, Cd, etc. it may cause the irreversible harm to the kidneys, brain and nervous system. It may also increase the risk of organ damage, issues with reproduction and even increases the risk cancer.

The environmental factors like soil, air and water pollution have serious negative effect on human and animal. It may increase the risk of diseases. It also raises the chancer, respiratory condition and other illness.

The nature and biodiversity is also impacted by pollution which causes ecological disruption. The pollution poisons food and water supplies endangering te health of people and animals, to deal with all these issues, better treatment end environmentally friendly procedures are needed to lower chemical pharmaceutical and environmental exposure.

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