OXALATE POISONING

An oxalate poisoning is a salt of oxalic acid this include potassium oxalate and sodium oxalate.

Aetiology:

A. Plants (natural source)

1. *Amaranthus retroflexus*
2. *Spinacia aleraces.*
3. *Beta vulgaris*
4. *Oxalis spp. O. corniculata O. latifolia*
5. *Caladnium spp*
6. *Mexican breadfruit (Monstera spp)*
7. *Setaria spp.*

B. Metabolic synthesis - Formed during the metabolism of ascorbic acid, this forms the insoluble form of the salt or urolithic

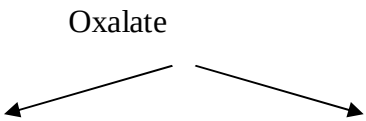
C. Oxalic acid (ingestion).

FACTORS AFFECTING OXALATES POSIONING

Annulus spp. – Cat and dog are susceptible to insoluble form while large animals to soluble.

- Animals left to move from one place to the other.
- Unacclimated animals might pick and eat plants that are poisonous.
- Extreme system of husbandry.

It is important to not that:



Soluble oxalates insoluble oxalates

MgO_{x1} sodium oxalate and NH_4O calcium oxalate

Insoluble form of calcium

Clinic Signs –

- Irritated oral mucosa stomatitis, that is Dysphagia
- Anorexia or animal go off feed. – It causes some nervous signs such as depression, convulsion may occur due to altered level of consciousness due to acidosis and cerebral damage.
- Stranguria; dysuria.

Soluble form of poisoning (Oxalate Mg, NH_4 Na)

- It causes hypocalcemia in ruminant as a result of acute poisoning
- Muscle weakness
- Recumbency
- In horses, it causes *Osteodystrophia fibrosis* when the horses take oxalate rich forage or long-term ingestion of plant.

Lesions:

- Slugging off the mucosa of oral cavity stomatitis, increased salivation.
- Precipitation of crystals in the kidney.
- Haemorrhages in central nervous system.
- Nerves, bones especially in horses.

Histopathologically

Cerebral nervous cell degeneration.

Haemorrhages

Necrosis, Nephritis

Urolith deposition.

The degeneration of the tubular cells lining of nephrons thus, results to the destruction of Mitochondria in the cells.

Diagnosis:

- History
- Clinical surveying
- Taking samples -
    a) Plant or food of animal
    b) Urine

c) Blood

These are analysed in the laboratory

Post Mortem

Histopathology

Treatment:

If the commercial form is ingested lime or calcium hydroxide solution should be given. This reacts with acid to produce insoluble form of calcium oxalate.

Use menthol or eucalyptus oil to soothe the buccal cavity.

ENVIROMENTAL TOXICOLOGY

History and previous dates to show why environmental toxicology is important:

- The great air pollution disaster of Meuse valley of Belgium in 1930.
- Donora Pennsylvania in 1948.
- London Smog of 1952.
- 1984 drew attention to the world of science on the consequences of pollution.

Air Pollution:

1. **Primary air pollutant** – These are pollutants which are directly released in atmosphere in enough concentrations without modifications e.g Co_2, hydrocarbons particulates, So_2 and nitrogenous compound (No, No_2).
2. **Secondary air pollutant** – The pollutants which interact with each other in presence of certain compounds, particularly energy sources e.g. nitrogenous compounds, ozone, peroxyacetyl nitrate (PAN).

Depending on the chemical nature, two types of pollution are recognized.

a) Reducing type of pollution – Pollution due to incomplete combustion of coal, fog and cool temperature.

b) Oxidizing type of pollution or photochemical air pollution – pollution due to hydrocarbons, oxides of nitrogen and automobile exhaust where intense sunlight causes photochemical reactions is polluted air masses.

Carbon monoxide – (Co) is the most notorious and abundant pollutant. It is present in lower atmosphere ambient air.

- Larger percentage are from natural sources, particularly combustion of fossil, fuel, atmospheric oxidation of methane, forest fires, terpenes oxidation and ocean microbes.
- Co is highly toxic because it has high affinity for haemoglobin (Hb), thus displaces Hb – bound oxygen and increases carboxy-haemoglobin (co-Hb).
- Dissociation of carboxy-Hb is a slow process this further reduces the availability of oxygen to tissue. The effect of co is not only on the delivery of O_2 by the blood tissue, but direct toxic effect of binding Co to cellular cytochromes contained in the respiratory and myoglobin.

Clinical signs of Co poisoning are:

* Sweating	* Irritability	* headache
* Insomnia	* dizziness	* Blurred vision
* Thirst	* lost of weight.	

The Co poisoning could occur in neonates since it crosses the transplacental barrier.

Sulphur dioxide:

Global emission of So_2 is more or less equal from natural and anthropogenic sources.

Natural sources - Volcanoes, decaying organic matter.

Anthropogenic sources – Combustion of sulphur containing coal and smelting of nonferrous ore.

Sulphur dioxide is readily absorbed on tiny particles of coal and oxidized to sulphur trioxides, sulphuric acid, ammonium sulphate, or other sulphates and may be transported to places the reaction is catalysed by manganese and vanadium. The sulphuric acid will come on the earth surface in form of acid rain.

Sulphur dioxide is a mild respiratory irritant and predominantly respiratory tract and causes bronchoconstriction. It increases mucus secretion and goblet cells and finally produces bronchitis. It impairs macrophage dependent host defence mechanism.

Injures the eye, causes inflammation of conjunctiva and irritation in the nose and throat. Long term exposure cause increases in mucus secretion of cells and thickening of mucus layers in the trachea. In rats, daily exposure to 10ppm of So_2 for 1-2months was found to cause thickening of the mucus membrane.

Hydrocarbons:

Biochemically, the aliphatic and alicylic hydrocarbon are generally inert bit not to the biological system.

Formalydehyde, other aldehydes ketones, and ozone etc cause irritation to the mucous membrane and system injury as a result of inhalation of aromatic vapour. The hydrocarbons are pollutants promote the formation of photochemical smog.

a) **Photochemical smog**: constituents cause eye irritation. 1µm or less may penetrate the lungs, however large particles of 2-5 µm do not reach the *alveoli*.
b) **Gasoline which constituents 20% benzene.** Benzene is a bone marrow poison. This produces myelocytic and acute Nonlymphocytic leukemia.
c) Ethylene affects plants growth in high concentration.

Particulate Matter:

This constitutes organic and inorganic particulates materials of different diameters, amongst which are metals, and oil. Beryllium and mercury from combustion of coals causes pneumonitis, this is also carcinogenic. Carbonaceous matter of about 50-60% of the total mass of fine particle matter. This at concentration require muco-cillary clearance, this causes exhaustion of the clearance mechanism. Progressively particles accumulate in the lungs, followed by cessation of clearance epithelium hyperplasia, adenosarcomas and squamous cell carcinoma, particles less than <5µm enter tracheo-bronchial tree and irritates the respiratory system.

Nitrogen oxides:

Nitrogen oxide is formed by lightening and microbial digestion of organic matter and by high temperature combustion of cellulose nitrate films.

Nitrogen dioxide is a deep lung irritant and thought to penetrate alveolar capillary membranes where it is converted to nitric acid and produces lung oedema.

Assignment: Read and submit notes on :

i) Ozone , ii) ozone depletion and iii) Green house effect.

Water Pollutants:

Any molecules present in water which are not water and are detrimental to health are termed as water pollutants. The pollutants released into or those present in environment may be partitioned amongst different environmental compostments.

Historically, Aldogate pump in London was closed in 1876. John Snow's investigation that contaminated water of pump was responsible for the epidemic of cholera.

Sources of Water Pollution:

Basically, it could be anthropogenic or natural sources of water pollution, examples are sewage, industrial units, cooling system, electricity, generating plants etc **are all added to rivers, lakes, pipes channel**. – these constitutes the **point source** of water pollution.

Non-point sources of water pollution are **agricultural land run offs, containing pesticides, fertilizers, nutrients, phosphorus salinity, acidity.**

Types of water pollutants:

a) Physical pollutants
b) Chemical pollutants.
c) Biological pollutants

Physical Pollutants: Water may be polluted with mud, grit, stone, lime, ash, mining wastes, aquatic fauna or heat / thermal Pollution due to absorption of solar energy, release of industrial cooling or power plants water discharges. These result into increased ambient temperature of water and decreased solubility of oxygen in water hence, oxygen deficit in water which will have adverse effect on aquatic flora and fauna.

Chemical Pollutants: A large number of minerals salts and metallic ions find their way into drinking water by natural or anthropogenic means e.g. Carbonates, bicarbonates, Sulfates and sodium. Other source of chemical pollutants are petrochemicals due to large spill from tankers and near shores, inorganic compound, airborne pollutants / acid rains, metals, chemical due to leaching of soil nutrients all these contaminate standing and surface water. Acid rain also results in the leaching of calcium, Magnesium, Potassium and Sodium out of the soil into the ground water and thus results into deficiency of these metal that are important to make the soil fertile.

Biological Pollutants

Aquatic fauna contribute significantly towards water pollution. Certain animals and plants found in the aquatic dwelling organisms in natural waters are known as planktons. These include wide variety of saprophytes holozoic and chlorophyllous forms of life, sponges, worms algae, creppers (snails/insects), others include zooplanktons. Aquatic fauna may prevent the beneficial aquatic fauna. Some algae planktons produce toxins causing toxicity. Some certain bacterial namely; *Salmonella typhi, shigella spp., E. coli,* fungi parasites and viruses contaminate water these may not produce disease until after a while.

Food Toxicants:

Food of animals and humans contain several naturally occurring substances which are toxic at high concentration. Food toxicants are classified according to their origin:
Fungi, bacterial, environmental contaminants or natural toxin present in plants. Some exogenous agents are sued as food additives and preservatives.

Natural contaminants of Food.

Food toxicants are unavoidable a lot of nutrient substances are present in plants. These contaminants are usually present for growth and survival of plants but produce deleterious effects of both humans and animals for examples; goiterogenous in *Brassica sp. Arachis sp. Linum sp,. Trypsin and chynotrypsin.* Inhibitorsin soyabeans. A*ntithiamine* in fish, and *ferns* (*Pteridum aquilinum*).

Similarly, heavy metals contaminants (lead, arsenic, cadmium. Chlorinated organic compounds (DDT, PCBS). Food born molds and mycotoxins (*Aspergillus sp, Penicillum sp., Fusanium sp.*,) Bacterial toxins (*Clostridum sp., Salmonella sp., E. coli.,)* Other natural constituents of plants like alkaloids, glycosides, tannis, saponnins etc are toxic.
In addition, plants also have toxic chemicals termed as Phytoalexins these are involved with the defense mechanism of plant defence.

Phytoalexins: Phytoalexins are low molecular weight, antimicrobial agents which are synthesized by plants and are stored in plants after exposure to microorganisms. Other factors which brings about he induction of the production of phytoalexins are exposure to bacteria, virus.

Exposure to cold. U-v light, heavy metals, salts, antibiotics, fungicides, herbicides. Some phytoalexins of food plants are;

Plants	**Phytoalexins**
1. Pea	Pisatin
2. Soybean	Glyceollin
3. Bean	Phaseollin
4. Rice	Oryzalexins
5. Castor bean	casbene
6. Carrot	falcarinol

Other phytoalexins are *isocoumarins, isoflavonoids, terpernoids*, etc. Induction of phytoalexin synthesis takes place after exposure. Other agents as mentioned above.

Alkaloids: Different types of alkaloids are present in various plants. *Nicotiana tobacum, Senecio, Crotolaria* and *Halotiopicum.* Some of these are consumed by animals to cause toxicity.

Glycosides: Cyanogenic glycosides in *Sorghum vulgare, Sudan grass, Digitalis purpurea,* and *Sapogenic glycosides* in soybeans. The mustard oils glycosides are toxic to animals.

Phytoestrogen: these are non-steroidal estrogenic substances of vegetable origin which cause infertility in animals on grazing. Some of the pasture species which cause problems in livestock – because of phytoestrogens are sub-terranean clover, red clover, isoflavoids (genistein, diadzein). Sheep is the worst affected the fertility decreases with time.

Oxalates and Phytates: Some certain plants are rich in oxalates and phytates. The consumption of which results in hypoglycemia, tetany and deposition of insoluble calcium oxalate crystals in the kidney and blood vessels. Phytates bind with di- and trivalent ion ($Cu^{2+,}$ $Zn^{2+,}$ $Co^{2+,}$ $Mn^{2+,}$ $Fe^{2+,}$ Ca^{2+}), others are as follows:

- Plant Phenolics
- Saponins
- Toxic amino acids and proteins.

Environmental contaminants: Some of the common heavy metals, namely; lead, arsenic, cadmium and mercury organometallic compounds, organic compounds pesticides (DDT, PCBS), nitrosamines, nitrosamides and, N-nitroso substance, nitrates fin soil, water, sewage etc. enter the food chain an pose threat to human and animal health. Some of the environmental

pollutants persist in the environment depending on the persistence, these are divided into three groups: persistent which decompose by 75-100% within 2-5 years, moderately persistent which decompose within 1-18 months and non-persistent which decompose in 1-12 weeks. The persistent contaminants having high lipid solubility have a greater bioaccumulation potential and predispose to greater toxicity tendencies.

Toxicants of animal origin:

Drug and chemical are used in animals not only for prevention and treatment of disease but also for promotion of growth. Residues of antibiotics, other drugs or pesticides in milk, meat or eggs of animals and birds have been detected and many a times certainly to exposure of various animals to some of the toxic agents in drugs above the tolerated level. Consumption of such animal products is important from public health point of views, both in human beings and animals and may result in chronic toxic effect. Similarly, contamination of food with micro organisms or chemicals during growth, processing, preparation and storage also pose threat to humans and animal health. Research had shown that environmental pollutants like heavy metals, agro-chemicals.

Radiation Hazards and Toxicity

Radiation is produced through decomposition or disintegration of an unstable naturally or synthetic elements.

Sources of radiation - Radioactive materials are being increasingly used in medicine, industry, agriculture and power generating reactors.

The sources are as follows:

a) Natural Sources.
b) Anthropogenic sources.

Natural sources: Cosmic rays from space and external terrestrial radionuclides composed mainly of the emission from Uranium, Uranium and thorium in geo-chemical environment consisting of certain rocks, soil and phosphate deposits. Solar radiation has assumed special significant effect on the ozone depletion effect. Other natural sources are of radiation are potassium^{40}, rubidium^{87}, hydrogen^{3}, carbon^{14}. Some of these elements possess very long half life

1.3×10^{10} years – 4.89×10^{11} years for K and rubidium. These exist in soil, water and muscles of a long time.

Anthropogenic Sources : Nuclear reactors that contain radio active Substances Contaminate Pasture and fields. There is also likelihood of water air – effluents discharges. The industrial unit using radioactive element also might result to contamination, research centres, - medical diagnostic units might have leakages that might result to environmental pollution of radiation, this will result to teratogenesis, mutagenesis, carcinogenesis, and the tissues of body are damaged.

Mechanism and Pathogenesis : Radiation toxicity represents a dynamic – Interaction with matter by direct or indirect processes to form ion pair, some of which are free radicals. The free radicals interact with Macromolecules that make up the Organelles of the cell. This cause damages to the D.N.A strands to cause breakage point mutation and chromosomal aberrations with the subsequent loss of those gene products coded for by that portion of D.N.A. if the code is required for the cell to maintain life, the cell therefore looses its physiological and structural functions and this result to death.

Types of Radiation Toxicity

i) Acute toxicity
ii) Subacutes toxicity
iii) Chronic radiation toxicity

Acute Toxicity: Direct and acute exposure to high doses or irradiation result to radiation sickness this is characterized by irritation of alimentary canal, resulting to refractory diarrhea, recumbency to polypnea, profused blood stained nasal discharges. It also results bone marrow depression this will cause reflected hymphopenia, granulocytes and thrombocytes decrease, this will cause coagulopathy, hair loss ulceration of the skin , secondary bacterial inflections and degenerative changes. Sometimes tumors, leukemia, might occur if the dose of exposure is 5000rads or more the animals might suffer central nervous system depression.

Sub-acute Toxicity: Following exposure to median doses of radiation, there is initial phase of radiation sickness which is characterized by anorexia, vomition, depression and weakness lasting for several hours to several days. It is followed by pyrexia knuckling at the fetlock,

swelling of leys, diarrhea, dysentery, polydipsia recumbency, hyper-irritability, several anaemia and septicemia in terminal phoses of toxicity

Chronic radiation toxicity: This is due to cumulative effect of exposure to radiation. The effect depend on the concentration of irradiation or amount of radioactive materials absorbed or feed to the animals, ages, breed, spp,etc. Radioactive iodine damages might cause thyroid gland damages, strontium bone tissue. Both of these are excreted in the milk and meat of such animals in turn adversely affects the human health. Others include alopecia, sterility, mutational changes, tumour of hemopoetic system leukaemia.

Local Irradiation:

Skin: High dose exposure to irradiation cause skin burns, Initiated by oedema of the dermis, followed by destruction of cells of epidermis hair follicles and sebaceous gland are destroyed.

Gut: Ulceration, enteritis, villi degeneration

Lungs: Pneumonitis respiratory depression hypoxemia, alveolar epithelial damage and endothelial damage.

Thyroid: hypothyroidism

Bone: Strontium^{89}, Berium, radium especially substitutes calcium in bones and suppress bone marrow and result in lymphopenia.

Reproductive Organs: 600rads radiation would cause testicular cell damage, permanent sterility, atrophy and degeneration of the ovary.

Liver: Acute hepatomegaly and jaundice.