

HEAVY METALS POISONING IN ANIMALS

Overview

“Heavy Metals” are chemical elements with a specific gravity that is at least 5 times the specific gravity of water. The specific gravity of water is 1 at 4°C (39°F). Some well-known toxic metallic elements with a specific gravity that is 5 or more times that of water are Arsenic, 5.7 Cadmium 8.65 Iron, 7.9 Lead, 11.34 and Mercury 13.546.

There are 35 Metals that concern us because of occupational or residential, exposure, 23 of these are heavy elements of “heavy Metals” antimony, arsenic, chromium, cobalt, copper, gallium, gold, iron, lead, mercury, nickel, platinum, silver, tellurium, thallium, tin, uranium, vanadium, and interesting, small amounts of these elements are common in our environment and diet and are actually necessary for good health, but large amounts above the average body trace quantity requirement would predispose to toxicity this could be acute or chronic (poisoning). In general Heavy Metal toxicity can result in damaged Mental and central nervous function, lower energy levels and damage to blood composition, lungs, kidney, liver kidney and other vital organs. The Agency for toxic Substances and Disease Registry “ATSDRS” lists TOP20 Hazardous substances amongst the TOP 3 are Arsenic, lead, mercury, others include Cadmium, iron, Aluminum

Arsenic Poisoning

Factor that affect arsenic poisoning

- Oxidation state of arsenic
- Solubility
- Species
- Animal Involved
- Duration of exposure.

Sources of poisoning: Poisoning occurs due to arsenic trioxide, arsenic pentoxide, sodium and potassium arsenite and lead or calcium

How animals are exposed:

- Drinking water containing more than 0.25% is considered potentially toxic
- Herbivores are commonly poisoned because they eat contaminated forage.
- Lead arsenate in dairy cattle.
- Lead arsenate is some times used as taenicide.
- Cats are exposed due to baits ingested for insects.

Toxicokinnetics

After absorption, arsenic is distributed throughout the body but tends to accumulate in the liver, and kidneys.

- Pentavalent arsenic is metabolized to trivalent.
- In domestic animals, arsenic does not stay in soft tissues for long period. It is rapidly excreted in bile, milk saliva, sweat and urine and faeces
- After chronic exposure the poison stays in bones, skin and Keratinized tissue such as hoof, hair.
- Arsenic does not cross the blood brain barrier
- Milk that is poisoned by arsenic can be toxic to humans.
- But flesh of poisoned animal is safe.

Clinical Signs

Acute: Profuse diarrhea, severe colic, dehydration, weakness depression, pulse, cardiovascular collapse.

Peracute: Animals is found dead.

Subacute cases: The animal may live for several days signs include colic, anorexia, depression, staggering, weakness, diarrhea, with blood and mucosal shreds

Chronic: Are rare and are characterized by wasting, poor condition, thirst, brick-red mucosal membrane, normal temperature and a weak and irregular pulse.

Postmortem lesions: In peracute cases, no signs may be seen, reddening of G1 Mucosa local or diffuse may occurs. Other lesions include Oedema, rupture of blood vessels, necrosis of epithelium and subepithelium. Necrosis may lead to rapture of stomach and intestine

Diagnosis:

- i. History
- ii. Clinical signs
- iii. Post mortem lesions
- iv. Chemical examination of arsenic in tissue between >1 to >3ppm is considered toxic.

Differential diagnosis

- Caustic poisoning
- Irritant paint
- Urea chlorate
- Pesticides poisoning
- Lead poisoning

Treatment

- Administration of G.1 protectants e.g. charcoal, kaolin-pectin
- Supportive fluid therapy
- Administration of BAL (Dimercaprol) at 4-5mg/kg, deep intramuscular
- Treatment of cattle and horses 8-10g in 10-20% solution and 20-30g in 300ml orally.
- D-Penicillamine is safe used at 10-50mg/kg, orally Tid or Qid for 3/7 or 4/7.

Lead

In Veterinary Medicine, lead is one of the most common causes of metallic poisoning in dogs and cattle. Only 1-2% of the ingested lead may be absorbed. The organic form of lead could penetrate intact skin. Organic forms are tetraethyl lead and tetramethyl lead.

Sources of poisoning

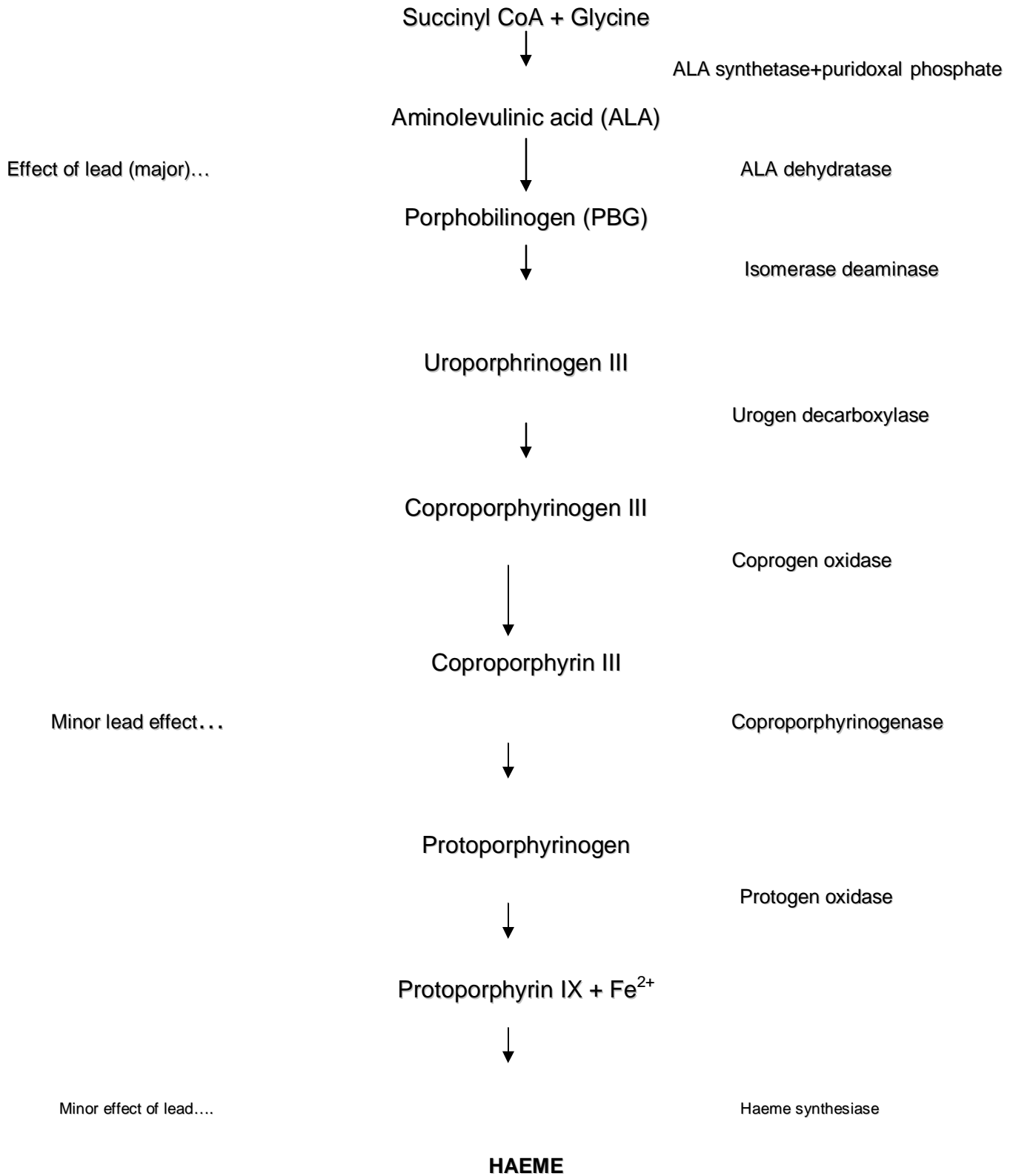
- Curious animals may ingest lead-based paints.
- Lead tetraoxide, carbonate, or sulphate
- Cattle is associated with seedling and harvesting activities
- Engine oil and lead battery disposal is handled in properly
- Petrol contaminate as tetraethyl lead

- Feeding animals with feed that was sprayed with lead insecticides (lead arsenate).

Toxicokinetics

- Lead salts are sparingly soluble
- Absorption of lead from GIT is very limited (1-2%) and therefore about 98% of lead is eliminated in faeces.
- After absorption 85-90% of the blood would be in sheep and 65-70% in cattle, this lead is carried in the cell membrane of the erythrocytes
- The remainder is bound to serum albumin and only small portion of (<1%) less than 1% is actually free. This form is in dynamic equilibrium with lead bound to erythrocytes and serum albumin
- The lead that is distributed to the soft free form of lead
- Lead passes the enterohepatic circulation to the liver, the liver contains large amount of lead.
- In the kidney the lead is also deposited and concentration is higher than the liver
- After which the lead would be redistributed to the bone this termed '**bone sink**' and the bone bears 90-98% of the lead this is considered as a detoxification mechanism.

EFFECT OF LEAD ON HAEME SYNTHESIS



Clinical signs

In cattle, GIT and nervous signs after 24 hours of exposure to toxicity include blindness, salivation, spastic twitching of eyelid, jaw champing, tremor, and convulsion.

In subacute poisoning, it is characterized by anorexia, rumen stasis, colic, dullness, transient constipation frequently followed by diarrhea, laryngeal and pharyngeal paralysis, roaring, and dysphagia.

Students should read up on other signs in horses and birds.

Pm lesions

- In acute lead toxicity lesions are fewer
- Oil, flakes of paint or battery may be seen in GI tract, leading to gastroenteritis could be seen

Flattening of cortical gyri

Histologically, endothelial swelling, laminar cortical necrosis and oedema of white matter may be evident.

Diagnosis

- History
- Clinical signs.

Post mortem lesions

- High concentration of lead above the normal level to 0.35 PPM. Instead of 0.05-0.25 PPM. and 10 PPM in liver and cortex of kidney.
- Basophilic, Anisocytosis, Poikilocytosis, polychromasia, hypochromia
- Blood urinary levels of protoporphyrin levels are sensitive indicators and levels of 500 mg/100 ml may be observed instead of 140 mg/100 ml.

Differential diagnosis.

- Polioencephalomalacia

- Nervous coccidiosis
- Tetanus
- Hypovitaminosis A
- Hyomagnesemic tetany
- Nervous acetonaemia
- Urea
- Insecticide poisoning
- Nervous poisoning

Treatment

- Magnesium sulphate (400mg/kg, per os) or rumenotomy (gastric lavage in case of dogs may be useful)
- Barbiturates tranquilizer may be useful to control convulsion
- CGEDTA. (Calcium disodium edentate) give intravenously or subcutaneously at (110mg/kg 1 day) Bid for three days.

Treatment of lead toxicity

- D-Penicillamine can be administered orally at 110 mg/kg/day for two weeks
- Calcium Phosphogluconate I.V recommended at 250-500.

Mercury

Sources of toxicity include inorganic mercury and salts mercury chloride, mercurous chloride, yellow mercuric oxide, red mercuric iodide, mercuric nitrate, Dogs and cats are susceptible to mercurial ointments and may lick the ointments if applied topically.

Organic source include (ethyl mercuric) Chloride and hydroxide, methyl mercuric dicyandiamide diuretic. Antiseptics containing Mercurio Chlome, Thiomercuric acetate and nitrate.

Toxicokinetics

- Soluble mercuric salts are rapidly absorbed from the gut while insoluble are slightly absorbed or insoluble salts.
- Once absorbed, Mercury gets distributed throughout the body and is stored mainly in the liver and kidney.
- Absorbed mercury is eliminated very slowly, chiefly in the urine, but to some solvent in the faeces saliva, sweat and milk.
- Considerable amount of the mercury are retained in the tissues in the indefinitely.
- Excretion is slow, the half life being 70 days

Toxicodynamics

The toxic doses of mercuric chlorides by oral route in different species are:

horse and cattle, 8g; sheep, 4g; dog, 0.2-0.4g. The compound is reported to cause high mortality in chicks when given at 250ppm in drinking water Methyl Mercury may interact with D.N.A. and R.N.A and binds with – SH groups resulting in changes in secondary structure of D.N.A and R.N.A.

Clinical Signs

- Gastro intestinal signs includes:- Vomiting, diarrhoea and colic
- Polydisia
- Albumiuria
- Anuria
- Dyspnoea
- Coughing & nasal discharge
- Fever

- Loss of appetite
- Mercurial ptyalism
- Necrosis of the jaw

Postmortem lesion

- Gastroenteritis:- stomatitis, gingivitis, acute parenchymatous nephritis
- Respiratory:- Oedema of lungs, hydrothorax, hydropericardium haemorrhages in epicardium and endocardium following inhalation
- Microscopic changes include necrosis of convoluted tubules of kidney.

Treatment:

First aid raw white of egg or milk

This is followed by gastric lavage with saturated bicarbonate solution or sodium formaldehyde sulfoxylate (5%)

If mercury falls on skin or topical application occurs you clean with water and soap Chelatin therapy with dimerceprol. The water soluble less toxic analog of BAL like DMSA. N-acetyl – DL Penicillamine (NAP, 15-50mg/kg.per os)

Aluminum

Aluminum (Al) is the second most abundant element in the earth's crust, with a wide distribution in the environment

In medicine insoluble salts of aluminum are used as antacids and anti-diarrhea agents: astringents, styptics and antiseptics and hydroxide is inhaled or cure silicosis.

Toxicology

Aluminum is poorly absorbed in the gastrointestinal tract (cell) and excreted through faeces. It is excreted also through milk and urine at a lesser extent

- It penetrates the BBB (Blood Brain Barrier)
- This metal is high reactive and reacts with principally the genetics apparatus

Inhalation of Al (as Bauxite) causes shavers disease characterized by weakness, fatigue, and respiratory distress. This syndrome is and pneumothorax. There are three neuro-encephalopathy associated with neurofibrillar the second neuro-encephalopathy is progressive

human encephalopathy with renal failure .and the third is progressive focal epilepsy
Aluminum has been associated with several human organic neurological conditions. There include Alzheimers senile and presenile. Dementia, a myotrophic lateral sclrosis and Parkinsons dementia

Manganese

Manganese is an essential element and many enzymes require its presence in order to function. This mineral has world – wide distribution and is used in steel making (to reduce oxygen and sulphur) steel alloys dry-cell batteries, including colouring and bleaching of glass.

Toxicology

Although manganese salts are slowly absorbed in the GIT and excreted via bile. The body burden of 20mg and is found chiefly in the liver, kidney, intestine and pancreas.

It could affect the respiratory system to result in manganese pneumonitis. Chronic inhalation results in toxicosis by manganese dioxide presenting as central nervous system disorder. The disease is characterized by psychiatric disorder irritability, difficulty in walking, speech, disorder, Parkinson like disorder. Manganese encephalopathy is characterized by selective damage to substantial nigra, globus pallidus, subthalamic nucleus, caudate nucleus and the putamen.

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SOME TOXIC PRINCIPLES IN PLANTS

Toxic plants may be defined as “one which detrimentally affects the health of a man or animals when eaten in such amount as would be taken normally or under circumstances like restriction of choice of diet or extreme hunger”

A plant is termed a toxic plant when through contact or ingestion hinders or destroys normal processes leading to distressing symptoms, pathology or mortality.

The toxic (active) principles present in the plants are called as phytotoxin. The toxic principles or phytotoxins are as follows:

- a) Alkaloids
- b) Terpenes
- c) Glycosides
- d) Organic acids
- e) Resins.

Alkaloids

Chemistry:

- They are basic nitrogen substances containing cyclic nitrogen.
- They are insoluble in water.
- Most occur in combination with plant acids.

Toxic alkaloids examples – Tropane (atropine like), pyrrolizidine alkaloids. Pyridine, quinolines, isoquinolines, Indole, quinolizidine, steroidal alkaloids, phenylamine.

Terpenes

Chemistry:

- They are 5-carbon skeleton of isoprene.
 - They are classified on basis of number of isoprene.
- (1) Monoterpenes e.g. cantharidin (C₁₀ compounds).
 - (2) Sesquiterpenes (C₁₅ compounds).
 - (3) Diterpenes (Aconitum sp.)

<u>Type of terpenes</u>	<u>Examples</u>
• Monoterpenes	Cantharidin, <i>Anamirta cocculus</i>
• Sesquiterpenes	<i>Coriaria myrtifoli</i>
• Diterpenes	<i>Aconitum sp</i>
• Terpenes	<i>Lantana sp</i>

Glycosides

Chemistry:

- The compounds are ether-like combinations of sugars with other organic structures.
- When two parts of the molecules are connected, they are non-active.
- But when two parts are separated from sugar moiety, they are active. E.g. aglycone, genin. The separation of aglycone becomes active to cause toxicity.

Proteinaceous Compounds

The proteinaceous compounds are harmless and often beneficial agents.

After ingestion, proteins get hydrolysed through various enzymatic reactions in the gastrointestinal system and amino acids are absorbed into the system for protein synthesis in the body.

There are some proteinaceous compounds of toxicological importance these include:

Type	Examples
Protein	Abrin from <i>Abrus precatorius</i> <i>Ricinus communis</i>
Polypeptides	Amatoxins, phallotoxins, <i>Amanita sp.</i>
Amines	Aminotryptaline from seed of <i>Sativus odoratius</i> , <i>phoradendron sp.</i> inosine from <i>Mimosa pudica</i> .

Organic acids

Chemistry:

These are mostly acids that are accumulated by the plants especially in their fruits.

e.g. malic acid, tartaric acid, citric acid or ascorbic acid. Oxalic acid that causes oxalate toxicity.

Oxalic acid - COOHCOOK COONa



Resins and Resinoids: Toxic plants are phenolic compounds. One of the most important naturally occurring phenolic resins in plants is tetrahydrocannabinol (THC) and related compounds from *cannabis sativa* (marijuana or hemp). Other examples poison ivy, poison oak hypericin from *Hypericum perforatum*.

Some poisonous plants in Nigeria

Plants containing **cyanogenetic glycosides**. Some Nigerian plants which contain cyanogenetic glycosides include: *Manihot esculenta* (cassava), *sorghum bicolor* (Guinea corn), *Phaseolus lunatus* (Lima beans), and *passiflora foetida* (Stinking passion flower).

The toxicity signs associated with these plants are: respiratory paralysis, excitement, convulsions and ultimately depression, peripheral neuropathy of optic nerves leading to blindness.

Plants containing Neurotoxic plants Alkaloids

The alkaloids present in such plants are as follows: Physostigmine, scopolamine, atropine nicotine, solanine, pyrrolizidine alkaloids and strychnine. Physostigmine is obtained from ordeal bean of Calabar or *Physostigma venenosum*.

Toxicology

It initially stimulates and depresses the C.N.S. larger doses produces convulsion.

The alkaloids causes marked skeletal muscle weakness, papillary constriction, fixed stare, curare-like paralysis of the limbs and respiratory muscles leading to death.

Scopolamine (hyoscine and atropine) are found in many species of *Datura spp* such as *D. innoxia* *D. metel*, *D. stramonium*.

Toxicology of Scopolamine – The clinical signs of animal poisoning by these alkaloids include dilated pupils and stiffness disturbances of locomotion, fasciculation, hyperaesthesia and convulsive twitching of muscle, excitement delirium, drowsiness, hallucination, dilated pupil, mental confusion, and loss of memory.

Nicotine – the plants include *nicotiana spp* (such as *N. tabaccum* and *N. rustica*).

Toxicology: the acute poisoning exhibit GIT symptoms dizziness, mental confusion, collapse, convulsion, and rapid death causes paralysis of respiratory, clonic spasms, muscular incoordination and coma.

Solanine

Solanine present in *Solanum spp* common in Nigeria environment contain this principle.

Toxicology – Solanine poisoning include GIT disturbances, dizziness, dilated pupil, mental confusion, coma, and death. Animals show signs of weakness incoordination trembling, starring eyes and dilated pupils.

Pyrrolizidine

Pyrrolizidine alkaloids are most serious plant-source environmental hazards. Plants which contain hepatotoxic pyrrolizidine alkaloids have caused poisoning referred to as molteno diseases in cattle in South Africa, winton disease of horses and of cattle in New Zealand, pictou disease of cattle in Canada, Van Es' walking disease in horses in USA, schweinsberger disease in Bavaria.

Toxicology

The symptoms are essentially disturbances of Consciousness, and appear after animals have consumed the plants or weeks. Animals wander aimlessly and stubbornly, pressing their heads continually against objects with which they collide and finally display maniac rages their behavior is suggestive of rabies but without the characteristics terminal paralysis associated with rabies.

Strychnine Containing plants

Strychnine (from species of strychnos) used as rodenticide, causes violent vomiting and convulsion through inhibition of spinal cord reflexes to produce extreme hyper sensitivity and tetanus-like, spasm.

Plants Present in Nigeria that predispose to photosensitization

Hepatogenous photosensitisation sensitization causing plants induce signs of C.N.S disturbances plants that are incriminated are as follows: *Gossypium* SPP. *Pteridium aquilinum* or (Bracken fern), is associated with convulsion, incoordination, paralysis, opisthotonus; death.

The toxic Principle Diterpene

Present in *Gossypium spp* from *G. Kraussianus*, causes C.N.S depression while gossypol induces convulsions.

Aflatoxins - Aflatoxins are toxic substances from metabolic processes of toxigenic fungi *Aspergillus Flavus* and *A. Parasiticus* Conditions favouring fungi growth: humidity (90-95%) and ambient temperature 24- 25°C

Aflatoxins are produced in varying quantities in a variety of grains, nuts, cotton seed meal, maize corns meals, wheat barley, oats and other cereals.

Isolation of aflatoxin fraction:- Fluorescence method using u-v Thin layer chromatography.

Identification using Fluorescence and types

- 1) Types B₁ and B₂ u-v light blue fluoresce.
- 2) G₁ and G₂ are dihydroderivatives of B₁ and B₂ fluoresce green.
- 3) Hydroxylated Metabolites of B₁ and B₂ aflatoxic and are excreted in milk. And are termed as M₁ and M₂.

The most toxic Aflatoxin: Aflatoxin B₁ (AFB₁) while B₂ and G₂ are present in less concentration.

Toxicity order: B₁ > G₁ > B₂ > G₂.

The β toxins closely related with structure of pyrroolidone. The β toxins are carcinogenic , teratogenic and hepatotoxic.

Mechanism of toxicity: Aflatoxins when ingested are bound to ruminal contents. 2-5% reach intestine. 100µg/kg is considered toxic to cattle. AFB is primarily metabolized by microsomal

cytochrome P-450. Aflatoxin is metabolized to an intermediate and reactive metabolite termed as AFB₁-2,3 epoxide other metabolites of AFB₁ are Q₁, P₁, B₂ and aflatoxicol.

Molecular perspective of Aflatoxin toxicosis

Aflatoxin B₁ interact with N-guanyl residue of nuclear DNA of hepatocytes to inhibit synthesis of DNA – dependent RNA polymerase activity, messenger synthesis RNA and protein synthesis and interfere with transcription.

B₁ also binds with endoplasmic steroidal ribosome binding site causing ribosomal dis-aggregation of ribosomes, there is degeneration of mitochondria.

Clinical signs: Aflatoxins may be acute, sub acute or chronic.

Acute toxicity: the dose is 4mg.kg of aflatoxins cause death of sheep, calves and pigs within 15 – 18 hours due to hepatic insufficiency. Clinical signs include anorexia, depression, ataxia, dyspnoea, anaemia, haemorrhages, bloody faeces, tremors, convulsions and death.

LD50 values of AFB₁ in some species

Species	LD50 value (mg/kg)
Rabbits	0.3 - 0.5
Ducklings	0.5
Cats	0.3 – 0.6
Dogs	0.5 – 1.0
Cattle	0.5 – 2.0
Horses	>2.0
Chicken	>2.0

Sub-acute toxicity

Consumption of sub lethal concentrations of aflatoxins for several days or weeks causes this condition which is characterized by symptoms of icterus, hypoprothrombinemia, haemorrhages and haematomas.

Chronic toxicity

Chronic aflatoxicosis is the most commonly occurring syndrome in domestic animals and birds. There are no signs of toxicity. The obvious signs of toxicity might begin in 1-2 months with decrease in feed efficiency, weight gain, productivity, icterus, ascites, oedema of lungs and

abortion in pregnant animals. Death had been reported in ponies following AFB₁ feeding at 0.075mg/kg per day. 26 – 32 days after 0.15mg/kg/day.

P.M. Lesions

- i) Liver is pale, firm and fibrosed.
- ii) Microscopically, centrilobular necrosis, bile duct proliferation and veno occlusions are main changes, hepatocytes are swollen and there are multiple foci of encrosis and fibrosis and hepatic carcinoma.
- iii) Kidneys are yellow and surrounded by wet fat in young calves.
- iv) Serous exudates in body cavities.
- v) Ascites and oedema.
- vi) Catarrhal enteritis.
- vii) Eversion of rectum.
- viii) Diarrhea and dysentery
- ix) Hemorrhages in thoracic and peritoneal cavities.

Diagnosis

1. history
2. Clinical signs.
3. Detection of AFT in feed, blood and milk.
4. Laboratory investigations.
5. Post mortem changes – both gross and microscopic lesions

Differential diagnosis

- i) Warfarin poisoning
- ii) Copper poisoning
- iii) Carbon tetrachloride
- iv) Pyrrolizidine
- v) Infectious hepatitis.
- vi) Coal tar poisoning
- vii) Other mould toxins.

Laboratory Investigation

- AFBs inhibit transportation of fats from the liver, so there are fatty degenerative changes in the liver.

- Blood examination of aflatoxicosis affected animal, elevation in blood urea nitrogen, serum blood protein. Aspartate amino transferase, alkaline phosphatase, isocitrate dehydrogenase, lactate dehydrogenase, gamma-glutamyl transpeptidase, glutamate dehydrogenase and bilirubin

Prevention and treatment

- i. Contaminated feed must be withdrawn immediately.
- ii. Provide easily digestible low fat and high protein diet/feed.
- iii. Supportive therapy with multivitamins.
- iv. 0.5% hydrated sodium calcium aluminosilicate as feed additive in the feed of pigs and lambs.
- v. Anabolic steroid stanozolol (2mg/kg) by I.M. injection at 4-5 days.
- vi. Activated charcoal at 6.7mg/kg intraruminally as 30% w/v
- vii. Oxytetracycline (10mg/kg, I.M. once daily).
- viii. Intravenously administered quantities of 5% dextrose.
- ix. Supplement diet with hepatotonics
- x. Administer antioxidants.

FDA considers aflatoxins in milk and meat as serious threat to human health.

Ergot alkaloids poisoning

Ergot is a parasitic fungus (*Claviceps purpurea*), which invades the flowers and spikelets of cereals, particularly rye, oats, barley, wheat and grasses.

Other fungus strains. *C. paspali*, *paspalum dilation* and *P. notatum* while *C.*

Cinerea .

Ergotism commonly occurs in cattle, sheep, and others.

Ergot contains a number of pharmacologically active alkaloids namely, ergometrine, ergotoxin, ergocornine, ergocristine, ergocryptine.

Toxicity (Ergotism): Ergot ingested pastures may cause diseased generally animals may show lameness, irregular gait and evidence of pain in the feet and the posterior extremities being chiefly affected as early as within 10 days.

Types of Ergotism

- Gangrenous ergotism or chronic ergotism
- Nervous or Convulsive ergotism or acute ergotism.

Gangrenous ergotism and its pathogenesis

- Occurs mainly due to *C. purpurea* disturbance of the vasomotor system.
- Ergot alkaloids are potent smooth muscle stimulants thus, resulting vasoconstriction, elevate blood pressure and induce strong uterine contractions (oxytoxic effect).
- Excessive vasoconstriction damages capillary endothelium and causes vascular stasis resulting blockede of capillaries which result in dry gangrene formation due to thrombosis and sloughing off hooves, ears and tail.

Clinical signs

- Reddening swelling
- Coldness
- Loss of hair or wool
- Lack of sensation of the affected parts followed by lameness, irregular gait and evidence of pain in the feet.
- Necrosis and eventually sloughing off of the part in birds, gangrene of the comb, wattles, tongue and beak are observed in addition to vesicular dermatitis.

Convulsive or nervous form of ergotism

Convulsive ergotism is called acute ergot poisoning is comparatively rare in animals, still commonly occurs in carnivores, horses and sheep and rarely in cattle when animals have free access to parasitized seed heads of grass (*paspalum dilution* and *calvicops paspali* for few or several days. There are indoles and lysergic acid derivatives probably results in stimulation of CNS by interfering with the functions of brain neurotransmitters. Ergot alkaloid mimic the action of dopamine in the CNS.

Clinical signs: Hyperirritability, excitability, muscular incoordination, ataxia, aggressiveness, kicking, weakness, recumbency, tremors, fatal convulsions, and death following failure.

Other signs include pharyngeal paralysis. Gangrene of the extremities may also be observed in this form of poisoning. Milk production and growth rate are depressed .

Diagnosis

- History
- Clinical signs
- Examination of the hay, straw or grain for the toxigenic fungi or mycotoxins
- Detection of the ergot alkaloids in body fluids and tissues

- Sclerotia may be found on the grass head grains or hay
- Abortion.

Postmortem lesions

- Necrotic lesions- gangrene of the extremities is almost diagnostic of the condition
- Grossly, mammary gland of females in late pregnancy are small and flaccid without any evidence of lacteal secretion
- Evidence of congestion, arteriolar spasms
- Ulceration and necrosis of the oral, pharyngeal, ruminal, and intestinal mucosae is characteristics in sheep.

Differential diagnosis

- i) Rule out the infections disease, trauma, abscess, neoplasm, haemorrhages as the cause of *C.N.S* stimulation for acute ergotism.
- ii) Deficiency or excess of selenium from chronic ergotism.
- iii) Other mycotoxic coses due to *fusarium spp* etc.

Treatment

- No specific antidote is there.
- Offending feeding, forege etc should be immediately withdrawn.
- Provide a warm, clean and stress free environment.
- Give symptomatic treatment.
- Oral purgatives (magnesium sulphate).
- Broad spectrum antibiotics

Gossypol poisoning

Gossypol poisoning:- Which is usually subcute or chronic, cumulative, and some times insidious, following consumption of cottonseed or cotton seed products.

Etiology: Gossypol, the predominant pigment and (*Gossypium spp*) and other polyphenolic pigments are contained within small discrete structure called pigment glands found in various parts of the cotton plant.

Gossypol is lipid-soluble readily absorbed from GI tract. It is highly protein bound to amino acids, especially lysine, and to dietary iron of gossypol is limited; most is eliminated in the faeces.

Clinical findings:

Signs may relate to effects on the cardiac, hepatic, renal, reproductive, or other system. Prolonged exposure can cause acute heart failure hyperkalemic heart failure.

Pulmonary effects and chronic dyspnea, secondary to cardiotoxicity causes direct effect on the patocytes. Phenolic compounds to reactive intermediates, or liver necrosis is secondary to congestive heart failure.

Reproductive effects include reduced libido with decreased spermatogenesis and sperm motility. There is decreased surge of testosterone advocated due to enzymes inhibition of steroid synthesis in testicular ley dig cells in males.

Lesions: Some animals have no obvious gross pathognomonic lesions, but copious amounts of tan to red-tinged fluid with fibrin clumps are frequently found in abdominal, thoracic and pericardial cavities. An enlarged, flabby, pale, streaked, and mottled heart. Skeletal muscles may be pale. Forth-filled trachea and edematous interlobular septa.

Diagnosis:

- History or dietary exposure to cotton seed meal or cotton seed over a relatively long period.
- Clinical signs: especially chronic dyspnea
- Lesions:- cardio myopathy and increased amount of fluid in various body cavities

Differential diagnosis

- Cardiotoxic ionophoric antibiotics toxicity
- Ammonia, nutritional or metabolic disorders (selenium, vitamin E, or copper deficiency)
- Infectious diseases
- Noninfectious diseases (pulmonary adenomatosis, emphysema)
- Mycotoxicoses caused by **fusarium SPP**

Treatment

- A high intake of protein, calcium hydroxide, or iron salts appears to be protective in cattle.

Students should read on prevention and control.