

**BIHAR ANIMAL SCIENCES UNIVERSITY**

**Bihar Veterinary College, Patna**

**Department of Animal Nutrition**

**Second Professional Year (UNIT-I)**

**Harmful Natural Constituents & Common Adulterants  
(Lecture-5)**

**Dr. Kaushalendra Kumar**

**Assistant Professor, Bihar Veterinary College, BASU, Patna**

**e-mail: [drkaushalbvc@gmail.com](mailto:drkaushalbvc@gmail.com)**

## **Point to be discuss.....**

- ✓ **Phenolic compounds**
- ✓ **Other toxins**
- **Classification of natural toxicants by their occurrence in feeds**
- **Management of Toxicosis**
- **Common adulterants in feed and fodder**

**9. Phenolic compounds:** Contain an aromatic ring with one or more hydroxyl groups.

*i. Gossypol:*

- Gossypol is a phenolic compound found in **pigment glands of cotton seed** (*Gossypium* spp.).
- The main concern from a toxicological point of view is with **free gossypol**.
- The **bound gossypol is physiologically inactive**, but because it is bound to protein and particularly **lysine**, so, it reduces the biological value of the protein.
- The physiological effects of free gossypol- **olive green yolks in hen's eggs, depress appetite & growth, ascites & tissue edema, cardiac lesions & male infertility** may happens.
- Gossypol form **complex with iron** and cause iron deficiency in livestock.
- Supplement iron source as **ferrous sulphate**, when fed with CSK to livestock.

*ii. Tannins:*

- Tannin have the **ability to precipitate protein** by forming hydrogen bonding, which contributing to the stability of the **protein-tannin complex**.
- Mainly there are two types of tannins- **Condensed & Hydrolysable tannin**.
- **Condensed tannin** are not readily hydrolysed and have complex structure (formed from the condensation of flavanols such as **catechin and epicatechin**).
- **Hydrolysable tannins** can readily hydrolysed by hot mineral acid to yield the sugar core.
- HT are astringent and adversely affect feed intake.

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- Low to moderate concentrations of Condensed tannin precipitate soluble plant proteins & thus **protect them against degradation in the rumen**, but if the proteins are too firmly bound to the tannins they are not digested in the small intestine.
- By protecting proteins from hydrolysis in the rumen, they **increase amino acid absorption** from the small intestine.
- They also modify gas production in the rumen, thereby reducing the danger of **bloat** & possibly reducing **methane production**.
- Condensed tannins are also claimed to **restrict the growth of gut parasites**.

## **10. Mycotoxins:**

- **Metabolites of fungi (molds) is toxic to animals.**
- **Toxigenic species within the three dominant genera as *Aspergillus*, *Penicillium* and *Fusarium*, occupy a wide range of habitats.**
- **Most common chronic effects in livestock are **decreased growth rate & feed intake**.**
- **Subclinical effects occurring in the liver, kidneys, GIT may be responsible.**
- **Diagnosis of mycotoxicoses is generally impossible from clinical signs or post-mortem examination or residues in tissues.**
- **Some toxic effects are secondary, for **aflatoxin B1 and T2 toxin which interfere with the immune system, increasing the susceptibility to infectious diseases**.**
- **Acute death in poultry (**Turkey X-disease**), liver cancer, lupinosis, sweet clover poisoning, facial eczema of sheep, ryegrass staggers & ergotism.**

## 11. Other toxins:

### *i. Plant Carcinogens:*

- Carcinogenic effects in livestock may occur due to consumption of a poisonous plant
- Bladder and intestinal cancer in cattle consuming **braken fern**.
- **Pyrolizidine alkaloids** have carcinogenic properties.

### *ii. Trimethylamine oxide & formaldehyde:*

- Occurs in certain types of marine fish & **impair iron absorption** when the fish are used in the diet of animals.
- Iron deficiency signs such as reduced growth, anemia & loss of hair pigmentation (**achromotrichia**) are observed.

*iii. Nitrates:*

- Nitrate toxicity in ruminant is also known as “**Oat hay poisoning**”.
- Large amounts of nitrate present in green oats & heavy dressings of nitrogenous fertilizers may enhance its concentration.
- Nitrate per se is relatively non-toxic to animals.
- Toxic effect in ruminants is caused by the **reduction of nitrate to nitrite in the rumen**.
- Nitrite, oxidises the **ferrous iron of haemoglobin to the ferric state, producing a brown pigment- methaemoglobin** (incapable of transporting oxygen to the body tissues).
- Toxic signs include **trembling, staggering, rapid respiration and death**.
- **Non-ruminants can tolerate nitrate but ruminants do not because the rumen bacteria convert nitrate to nitrite.**

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- As reported, toxicity may occur in animals, grazing herbage containing more than 0.7 g nitrate-N/kg DM (2.8 g NO<sub>3</sub>), although the lethal conc. is much higher than this.
- Acute nitrate toxicity is treated with I/v methylene blue solution (2 to 4 mg/kg to 15 mg/kg BW i/v in 1% solution) or ascorbic acid (reducing agents) which accept electrons for NADPH reductase in blood & accelerate the reconversion of methaemoglobin to functional haemoglobin.
- Oral dose of mineral oil (1 lit. For adult cattle) or 500 g sodium sulphate in saline drip per cattle as supportive therapy.

## Classification of natural toxicants by their occurrence in feeds:

Feedstuffs	Toxicants
<b>Grains</b>	
All	Phytates, Mycotoxins
Rye, Triticale	Trypsin inhibitors, Ergot
Milo	Tannins
<b>Tubers</b>	
Potato	Solanum alkaloids
Cassava	Cyanogenic glycosides
<b>Protein supplements</b>	
Soybean	Trypsin inhibitors, Lectins, Goiterogens, Saponins, Phytates, Mycotoxins.
Cottonseed	Gossypol, Tannin, Cyclopropnoid fatty acid, Mycotoxin

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<b>Feedstuffs</b>	<b>Toxicants</b>
<b>Rapeseed / Mustard oil cake</b>	<b>Glucosinolates, Tannins, Erucic acid, Sinapine</b>
<b>Linseed meal</b>	<b>Linamarin, Linatine</b>
<b>Fava beans</b>	<b>Tripsin inhibitors, Vicine, Lectins</b>
<b>Forages</b>	
<b>Legumes:</b>	
<b>Alfalfa</b>	<b>Saponins, Phytoestrogens, bloating agents</b>
<b>Red clover</b>	<b>Slaframine, Phytoestrogens, bloating agents</b>
<b>Sweet clover</b>	<b>Coumarin</b>
<b>Leucaena spp.</b>	<b>Mimosine</b>
<b>Grasses:</b>	
<b>Tropical grass, Paddy straw</b>	<b>Oxalates</b>
<b>Forage Brassicas</b>	<b>Brassica anemia factor</b>

## **Management of Toxicosis:**

**The management plan for toxicologic emergencies, as follows:**

- **Institute the necessary emergency and supportive therapy to keep the animal alive.**
- **Establish a tentative clinical diagnosis on which to base therapy.**
- **Institute the appropriate remedial and antidotal procedures.**
- **Identify the toxic agent as rapidly as possible.**
- **Determine the source of the toxin.**
- **Counsel the livestock owner on the hazards of the implicated toxicant, & provide instruction for the avoidance of the problem in the future.**

## Common adulterants in feed and fodder:

- Adulterant can be defined as intentional admixture of a pure substances with some low quality substances for earning more profit.
- Feed adulterant can be checked in lab. By different methods: **Chemical analysis, Bioassay assessment (less common method) & Feed microscopy**

Feed ingredients	Adulterants
Groundnut cake	GNC husk, urea, UNCF cakes
Mustard cake	Argimona maxicana seed, urea, UNCF cake
Soyabean meal	Urea, hulls
DORB, Wheat bran	Ground rice hulls, saw dust
Fish meal	Common salt, urea
Mineral mixture	Common salt, marble powder, sand, lime stone
Molasses	Water
MBM	Leather meal, blood meal, sand
DCP	Calcite powder, rock phosphate

**Discussions.....**

**Questions, if any.....??**

**THANKS**