**Kurdistan Region – Iraq**

**Salahaddin University – Erbil**

**College of Agriculture Engineering Science**

**Animal Resources Department**

**Subject: Feed and Feeding - Theory**

**Stage: Second**

**Lecture Title**

**Anti-Nutritional Factors in Animal Feed**

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**Antinutritional Factors :**

Defined as those materials present in the diet which by themselves or their metabolic products inhibiting feed digestions, reduce production and affects the health of the animal.

These anti-nutritive substances are often referred to as “toxic factors” because of the harmful effects they produce when eaten by animals.

Plants commonly synthesize a range of secondary metabolites as part of their protection against herbivores, insects and pathogens that is to survive in adverse growing conditions. If farm domestic animals consume these plants.

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| **Toxic substances** | **Crops** |
| Saponins | Lucerne (alfalfa) |
| Tannins | Fodder tree/Shrubs |
| Oxalates | Guinea Grass, Seteria Grass, |
| Gossypol | Cottonseed  |

**Classification of Anti nutritional factors:**

**1-According to their chemical properties:**

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| --- | --- |
| **Group 1: Proteins**1. Protease inhibitor2. Haemagglutinins (Lectins | **Group 3: phenols**1. Gossypol2. Tannins |
| **Group 2: Glycosides**1. Saponins2. Cyanogen’s3. Glycosylates (Goitrogens) | **Group 4: Miscellaneous**1. Anti-metals2. Anti- vitamins |

**2-According of nutrients that are affected directly or indirectly**

**Substances depressing digestion and metabolic of proteins:**

1. Protease inhibitor (Trypsin and Chymotrypsin inhibitor)
2. Haemagglutinins (Lectins)
3. Saponins
4. Polyphenolic components

**Substances reducing solubility or interfering with the utilization of Minerals:**

1. Phytic acid
2. Oxalic acid
3. Glycosylates (Ioglucomides)
4. Gossypol

 **Substances increasing the requirements of certain vitamins:**

1. Anti-vitamin A, D, E, K.
2. Anti-vitamin B1, B6, B12 and Nicotinic acid.

 **Substances with a negative effect on the digestion of carbohydrates**

* 1. Amylase inhibitors
	2. Phenolic compounds
	3. Flatulence factors

**Protease inhibitor**

 Substances that have the ability to inhibit the proteolytic activity of certain digestive enzymes. legume seeds: soyabean, kidney bean, mung bean.

 Protease inhibitors are two types:

**a**. Kunitz inhibitor (inhibits only trypsin)

**b.** Bowman-birk inhibitor (inhibits trypsin and Chymotrypsin).

The inhibitory substances are mostly heat labile and proper heat treatment inactivates the protease inhibitors. Overheating can damage some nutrients such as amino acids and vitamins.

Trypsin inhibitor of soybean inhibits with the availability of methionine from the raw soybean.

**The important factors controlling trypsin inhibitor are:**

 1. temperature

2. duration of heating

3. particle size

4. moisture level.

**Saponins**

Saponins are secondary compounds that are generally known as non-volatile, surface-active compounds which are widely distributed in nature, occurring primarily in the plant kingdom. Saponins are characterized by bitter taste, and haemolyse red blood cells.

saponins are less important because their levels are low in most feed ingredients for monogastric animals. Their toxicity is related to their activity in ruminants. The common forages which cause saponin poisoning of livestock are Lucerne, soybean.

Average Saponin content of the leaves are twice as much as those of the stems and that the saponin content decrease as the plant become older. Excess feeding of green lucerne or legume forages saponins leading to accumulation of gas, condition is known as “bloat”.

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| **Source** | **(% dry weight)** |
| Soybean | 5.6 |
| Chickpea | 3.6 |
| Lucerne (Medicago sativa)  | 2.5 |

**Gossypol:**

Gossypol is present in leaves, stem, roots and cotton seed. It is highly toxic to simple stomach animals. Ruminants are more resistant due to the formation of stable complexes with soluble protein in rumen, which is resistant to enzymztic breakdown. Gossypol form complex with metals like iron and the toxic effect can be overcome by supplementing iron as ferrous sulphate. Cottonseed with total gossypol (0.002% in free form) are available.

**Physiological effects of Gossypol includes: -**

1. Reduced appetite

2. Loss of body weight

3. Accumulation of fluid in the body cavities

4. Cardiac irregularity

5. Reduced O2 carrying capacity of the blood