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Lecture title: **Animal nutrition: Animal feedstuffs**

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Summary:

Animal feedstuffs usually introduced to farm animals as a concentrated feeds as well as roughages depending on the animal requirements and the type of its nutrient's contents especially the total digestible nutrients and crude fiber as follows:

1. **Concentrated feeds:** less than 18% crude fiber with high protein and energy.
2. **Roughages feeds**: more than 18% crude fiber either as:

- Dry matter (hay, straw, etc.)
- Green feeds (green fodder, pastures)

Nutritive Value (NV)
Nutritive value refers to a feed's protein, mineral and energy composition, availability of energy, and efficiency of energy utilization.

Palatability
Palatability refers to the appeal and acceptability of feedstuffs to an animal. Palatability is affected by the:

- feed's odor
- texture,
- Moisture
- physical form
- temperature.

For a forage to be considered "high-quality," it generally must be highly palatable. Also, Palatability is a plant trait that can be measured when the animal has the opportunity to selectively feed.

Particle Size
Particle size refers to:
1-the diameter of granular feed materials (e.g., grains, pellets, mineral particles)
2- the length
3- the width of roughage or forage fragments.

Particle size can affect mixing of feed ingredients and digestion rate.

Based on their composition and use, feeds are classified as:

(1) dry forages (e.g., dried pasture, leaves, stems, green chop)
(2) roughages (e.g., hay, straws)
(3) green pasture
(4) silages (e.g., ensiled corn, alfalfa, and grass)
(5) energy feeds (e.g., corn, wheat, barley, and rice)
(6) protein feeds (e.g., soybean meal, meat and bone meal, blood meal, poultry meal, and milk replacer)

Silage

Silage refers to the feed preserved by an anaerobic fermentation process (e.g., corn silage, high moisture corn) in which lactic acid and volatile fatty acids (produced by fermentation) lower the pH of the silage. The low pH preserves the silage.

Silage Additives

Silage additives refer to the substances added during the ensiling process to enhance production of lactic acid and rapid decrease in pH of the feed.

Rumination - continuous reguritation, chewing and swallowing of feedstuffs.

Eructation - elimination of gases (methane and carbon dioxide) from the rumen due to fermentation process.

Digestion: it is the preparation of food for absorption by reduce feed particles to molecules that can be absorbed into the blood.

Absorption: it is the process that results in the passage of small molecules from the lumen of the GIT through the mucosal cells lining the surface of the lumen and into the blood of lymph.

ideal rumen environment:

Under normal feeding conditions, the rumen shows several characteristics:

- a mean temperature of 39°C (38–40°C)

- pH 5.5–6.8 (depending on the type of feedstuffs) in particular, when a large amount of monosaccharides or starch is added to forage diets, fiber digestion is impaired.
- a mean redox potential of −350 mv (a strong reducing environment without O_2)
- The presence of CO_2 and methane as the major gases.
- The extreme anaerobic environment in the rumen is responsible for its unique features of digestion.

Dry Matter

Dry matter (DM) is what remains when moisture is removed from a feed. The composition of the dry matter is dependent on the relative proportions of cell walls and cell contents. The cell walls consist of cellulose and hemicelluloses, reinforced with lignin. The cell contents include the water-soluble carbohydrates and much of the proteins. The amino acid composition of forages is clearly important when the feeds are used as protein sources for non-ruminants. For ruminants, the most important characteristics of forage proteins are their rumen degradability and their overall digestibility. The DM of a feedstuff can be divided into main two groups organic and inorganic matter:

1-**Organic Matter (OM)**: included

- Crude proteins
- Energy (Carbohydrates and Lipids

2- **Inorganic Matter (IOM)**:

Ash (minerals) macro-minerals and micro-minerals

3- **Undesirable Substances**

- Natural substances such as gossypol in cotton seed, prussic acid in sorghum, goitrogenic substances in the Brassica family, aflatoxin in groundnut products, oestrogenic substances in some legumes.
- Contamination due to improper handling for example soil in silage, dirt in milling products, and mould in hay
- Adulteration contamination with sawdust, sand, etc.

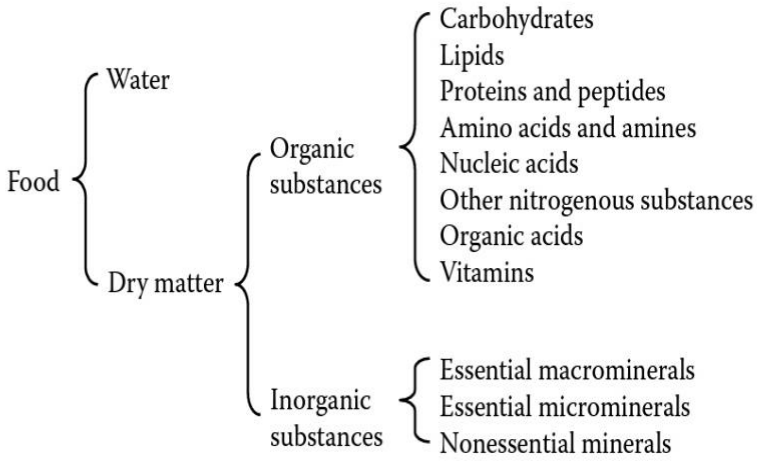

Figure (1): Composition of foods from plants and animals.

Many organic compounds have mineral elements as structural components. Proteins, for example, have sulphur, many lipids and carbohydrates have phosphorus. plants store energy largely in the form of carbohydrates such as starch and fructans, whereas an animal's main energy store is in the form of lipid.The lipid content of the animal body is variable and is related to age, the older animal containing a much greater proportion than the young animal.The lipid content of living plants is relatively low. The digestibility of the organic matter is one of the main factors determining the nutritive value of forage.

DM of a feedstuffs is important for several reasons, including:

1-Buying forages.
2-Ensiling forages.
3-Making hay.
4-Comparing feedstuffs. It is imperative to compare the composition (nutrient and energy) of different
feedstuffs on a DM basis.
5-Formulating and Mixing rations for herd feeding.
6- We want to minimize mold growth and heating.
7- Water is an essential nutrient, but does not contain energy, required to make milk.

Proximate or WeenDe analysis of feedstuffs:

The traditional method used to determine the nutrient composition in feedstuffs and animals is known as the proximate or Weende analysis, readily provide information on (1) Crude protein

(CP), which is determined by the Kjeldahl analysis of total nitrogen (2) Carbohydrates, which are separated into crude fiber and nitrogen-free extract (NFE); (3) NFE, which is a misnomer in that no extract is involved.

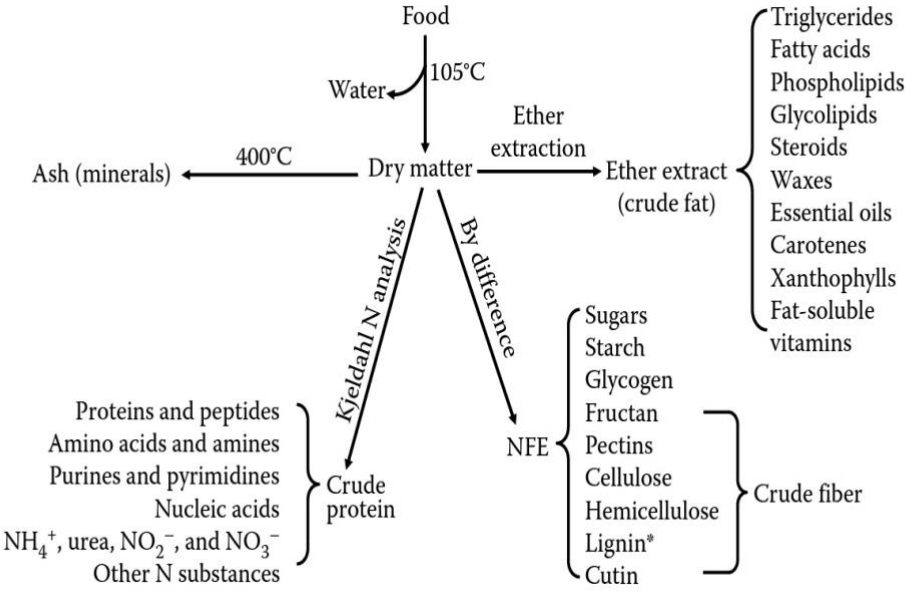

Figure (2): Proximate analysis of nutrients in feedstuffs and animals' tissues.