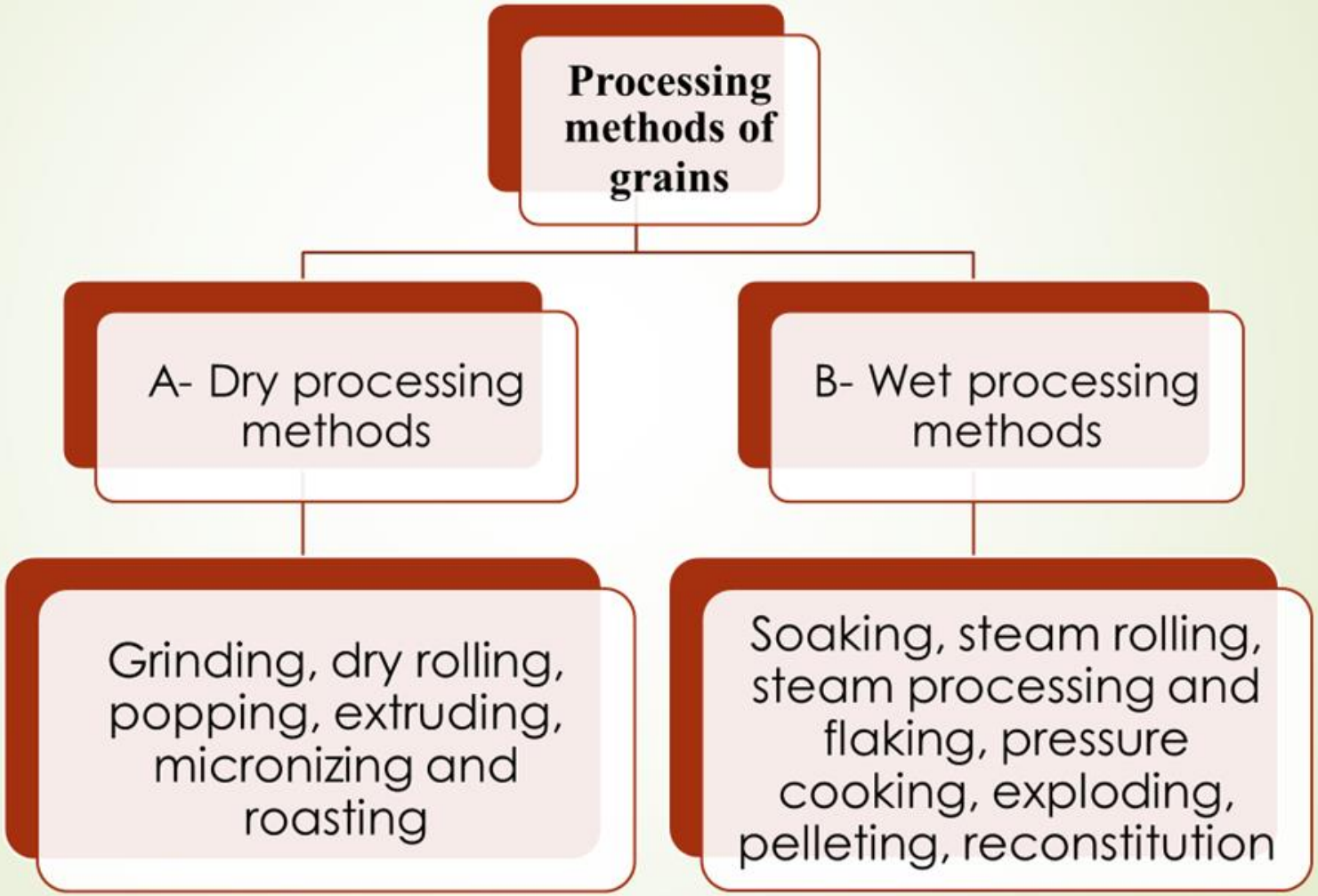
UNIT 4

Feed Technology, Feeding Experiments and Standards

1. Processing of Concentrates
2. Processing of Roughages
3. Feeding Experiments
4. Feeding Standards
5. Conservation of Feed through Silage and Hay

1. Processing of Concentrates



A. Dry processing methods

1. Grinding

simplest and least expensive

by means of a hammer mill.

vary from fine to coarse depending upon mesh size of the sieve/screen.

Very fine grinding= dusty and less palatable

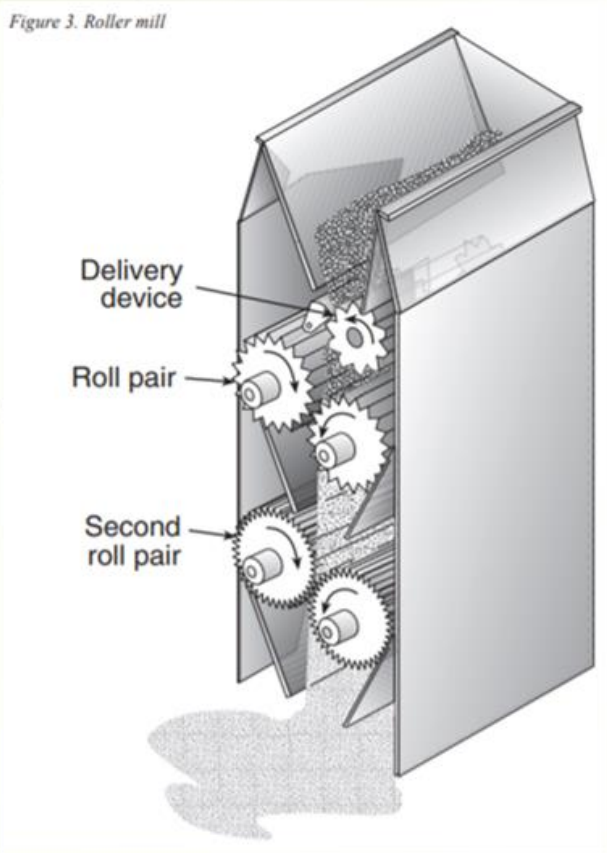
Expressing particle size of grounded material

- Grounded feed is expressed in terms of modulus of uniformity and modulus of fineness.
- Modulus of uniformity is expressed as ratio of coarse: medium: fine particle with suitable ratio will be 1:6:3.
- Modulus of fineness varied fro 1 to 7 and decreased with decrease of particle size of grounded material.

Advantages

- Grinding increased surface area thereby improved digestibility.
- Improved performance of animals by increasing nutrient utilization.
- Grinding makes mixing uniform and more efficient.
- Using grounded material makes pelleting and extruding easy, more effective, and efficient.
- Grinding reduced risk of particle segregation.
- /avoided by the grinding of grains. Selective feeding and risk of wastage by livestock will be minimized
- Grinding improves palatability.
- Grinding reduce energy loss occurs during mastication

2-Dry rolling



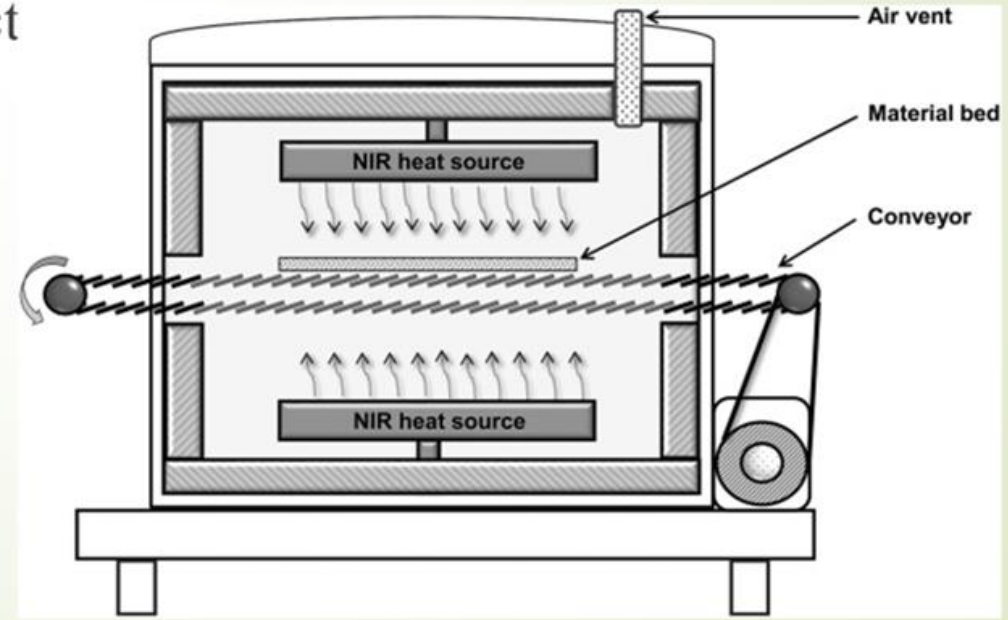
- Rolled grains are prepared by passing the grain through a roller mill.
- The physical properties of rolled grains are very similar to the of grains coarsely grounded in hammer mills.
- There is less issue of variation in the size of grounded material in rolling (material is uniformly grounded).

3-Popping or puffing

- Popping is produced by the action of dry heat (370-425 degree celsius) for 15-30 sec.
- Popping caused sudden expansion of grains which rupture the endosperm and this is responsible for the rupture of starch granules and makes starch more available for the digestion.
- Popped grains are less in moisture and are bulky in nature.
- Popping improved palatability, feed intake and digestibility.
- Puffed grains are good carrier of molasses.

4-Micronizing

- Micronizing is similar to popping except that heat generated is in the form of infra-red energy.
- Micro waves with 3 x 10^8 to 3 x 10^{11} cycles/sec are emitted from infra-red burner.
- Generally micronized grains are rolled to produce a uniform dense product



5-Roasting

- It occurs by passing the grains through flame resulting in heating to about 300 degree Fahrenheit or 148.9 degree Celsius.
- Roasting results into the expansion of grain starch to a certain extent which produce a palatable product.
- Moisture content of the roasted grain is around 3-5%.

Drum type grain roaster

6-Extruding

- Extrusion is used by the feed industry in the production pet feeds, fish feeds, laboratory animal feeds, etc.
- Extrusion results in the gelatinization of starch in variety of cereal grains and also cooking of soybean and pulses for the control antinutritional factor.
- It also used in the cooking of meat, fish, and feather meals for the control of pathogenic agents (salmonella).
- Gelatinization of starch results into the improved digestibility, feed conversion efficiency and performance of the animal.

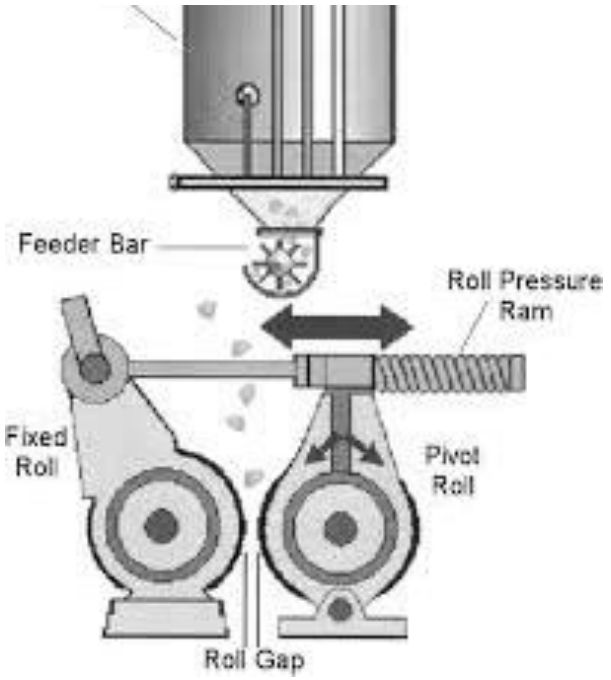
B-Wet processing method

1-Soaking

- Soaking of grains for 12-24 hours in water improved palatability and intake of soaked grain.
- Soaked concentrate mixture feeding is popular in swine feeding.
- Soaking of MOC, till cake and other feedstuffs remove certain antinutritional factors.

• Steam conditioning is a process where grains are exposed to steam at 210-215°F for 8 to 20 minutes.

• subjecting grains to 22-60 psi pressure for 50 seconds to 2 minutes is a conditioning method aimed at enhancing their quality by improving moisture absorption, digestibility, and overall nutritional value.

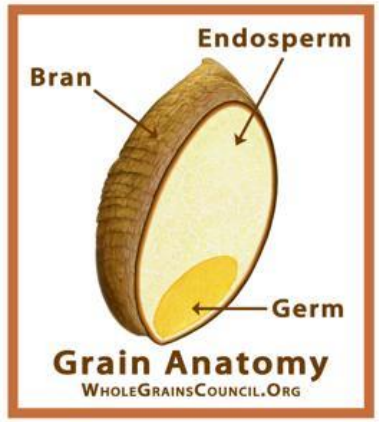


3-Steam processing and flaking

- Somehow similar to the steam rolling. After steam treatment, grains are passed through the roller mill.
- The tolerance set between the rollers depends upon the flatness of the flake desired.
- Drying is required while storing the steam processed and flaked grains.

4-Pressure cooking

- Pressure cooking is similar to the steam rolling or steam processing and flaking.
- Grains are pressure cooked at 50 psi for 1.5 min in air tight pressure chambers at temperature 300 degree Fahrenheit.
- The temperature is reduced to below 200 degree Fahrenheit and the moisture to 20% by passing them through cooling and drying tower prior to flaking.
- Pressure cooked grains are difficult to flake to the same degree of flatness due to spongy nature of the pressure cooked grain.
- Pressure cooked flakes are less brittle and therefore not break.



5-Exploding

- It is done by subjecting grains to high pressure steam (250 psi) for very short time (20 sec) followed by sudden decrease to atm pressure.
- This results into rapid expansion of grain kernels and produced a low density product (similar to popping).

6-Reconstitution

- Reconstituted grains are matured grain (10% moisture) to which water is added to raise the moisture level to 25-30% and wet grains are stored in an oxygen-limited silo of 14-21 days prior to feeding.
- Reconstitution of grain increases the solubility of the grain protein.

7-Pelleting

- Pelleted feeds are agglomerated feeds formed by extruding feed/grain by forcing and compacting and forcing through die openings by any mechanical process.
- The purpose of pelleting is to change dusty and unpalatable feed material into more palatable, easy to handle large particles by application of optimum amounts of heat, moisture and pressure.
- The normal size of the pellets is 3.9-19 mm with most optimum particle size of pellets are 6.25-9.4 mm.

Advantages of pelleting

1. Increase the palatability and therefore increase feed intake.
2. Increase the density of feed and thereby reduce the storage space required.
3. The segregation of ingredients in a mixing, handling or feeding process is prevented.
4. Waste during the eating process is minimized.
5. Requires less labour (easy to handle) in pelleted feed handling as pelleted material is free flowin.
6. Heat labile inhibitors are destroyed , gelatinization of starch occurs.
7. Feeding pelleted feed improved performance of the animals.
8. Bulk density is increased, which enhances storage capabilities of most bulk facilities. Shipping facilities are also increased, thereby reducing transportation costs.
9. Feed in pellets forms reduces natural losses because it reduces the formation of dust.

Disadvantages of pelleting

1. Increase the cost of the feed due to the pelleting process.
2. Decrease eating time, creating more boredom.
3. Decrease the amount of fiber a animal receives.
4. Poor-quality feed ingredients can be hidden in a pellet.
5. Excessive heat during the pelleting process may decrease the availability of amino acids such as lysine and may destroy some Vitamins.
6. Greedy eaters may be more prone to choke, colic, or other digestive disorders.

1. Which of the following involves the irreversible destruction of the crystalline order in starch granules to make the surface of every molecule accessible to solvents for improving digestibility? Mppsc 2023

[A] Reconstitution
[B] Extruding
[C] Pelleting
[D] Micronizing

2. The stages involved in processing of animal feed include: **Kerala PSC**

(A) Receiving and cleansing of the raw materials
(B) Pelleting and crumbling
(C) Grinding and mixing of the ingredients
(D) Steaming and cooking of ingredients
Choose the correct sequence given below:
a) (A), (C), (B), (D)
b) (A), (C), (D), (B)
c) (B), (D), (C), (A)
d) (A), (D), (B), (C)

3. In wet processing method, the reconstitution of grains is done to raise moisture level to **MPSC – 2019**

(1) 35-40%
(2) 25-30%
(3) 15-20% "
(4) 12-15%

4 Grinding of grains increases the digestibility, because of: Opsc 2013 -14
(a) Slower rate of passage in digestive tract
(b) Faster rate of passage in digestive tract
(c) Increased surface area for enzymatic action
(d) Decreased surface area for enzymatic action

5. Which of the following is a wet processing method for grains?

•a) Grinding
•b) Soaking
•c) Crimping
•d) Pelleting (dry)

6. What is the main objective of pelleting (moist)?

•a) To reduce feed density
•b) To increase dustiness
•c) To densify grain with steam or moisture
•d) To decrease palatability

7. Which of the following methods involves exposing grains to steam under high pressure and then suddenly reducing it to atmospheric pressure?

•a) Reconstitution
•b) Exploding
•c) Extrusion
•d) Crimping

8. What is the result of roasting grains?

•a) Gelatinization
•b) Inactivation of enzymes or inhibitory factors
•c) Swelling of grains
•d) Moisture absorption

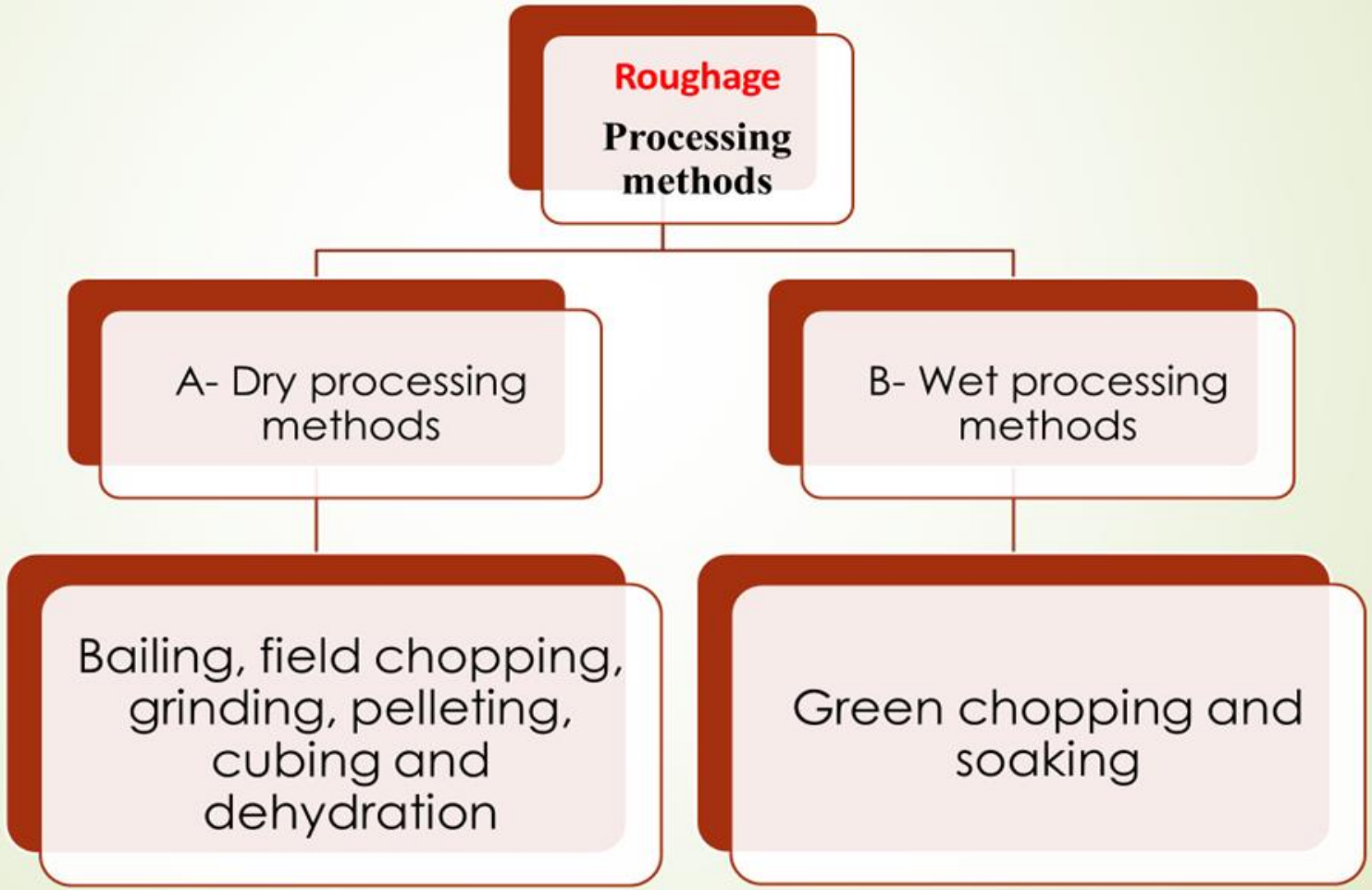
9. Which dry processing method is the least expensive for reducing particle size of grains?

•a) Grinding
•b) Popping
•c) Extrusion
•d) Crimping

10. Which method increases the solubility of grain carbohydrates and protein by raising the moisture content to 25-30% and storing it for 2-3 weeks?

•a) Reconstitution
•b) Soaking
•c) Pelleting
•d) Exploding

2. Processing of Roughages



A-Dry processing methods

- *In these methods water content is reduced to a desired level.*

Baling

- The forage is cut and dried in the field condition.
- Dried forage is then baled or bundled with Baler
- By this method we make storage and handling of forage easy and convenient.

Chopping (Chaffing)

- The forages are chopped into small pieces as fine or coarse particles.
- Chopping avoids the selective feeding thus wastage of plant material is reduced.
- The machine used for the intended purpose is called chaff cutter.
- Chopping facilitates easy handling due to increased bulk density.
- Also improves digestion due to exposure of relatively large surface roughages for microbial digesting.

Grinding

- It is a process of particle size reduction.
- Course grinding: roughages improves the feed consumption and growth rate
- Fine grinding: reduce the digestibility of CF: due to faster rate of feed particles in GIT (reduce milk fat content).
- High cost: grinding of roughages is not economical.

Roughage-Pelleting

- The ground roughages are pelleted and fed to animals.
- Improves the consumption of poor quality roughages.
- The size of pellets is 12/64” to 48/64” and has a density of 40 lb/ cft.

Advantages

- Pelleting roughages puts them in free flowing form
- Must be ground prior to pelleting – expense
- Reduce space requirement by as much as 75%
- May increase intake of forages
- Reduces dustiness
- Increase efficiency for low-quality forages

Disadvantages

- Cost of additional processing (more costly for roughage than for concentrate)
- Reduces the roughage value of hay

Dehydration

- It is a process of reduction of moisture content in a dehydrator using a temp. 600-1500^{0}F for a short time period of 3-5 minutes.
- dehydrated forage: retains: lot of DM and CP
- No loss of leaves, but carotene content is reduced.

Cubing

- It increases the density of roughages upto 30lb/cft.
- good quality hay is sprayed with water to increase the moisture content upto 14%.
- broken down rather than to ground the roughage, so that there is minimum of fine particles in the cube.
- Cubing: Alfa- alfa hay is done: Developing country.

B: Wet processing methods:

- 1. Soaking is a process of mixing or spraying water on roughages so that stems become soft and mixing of concentrates with roughage is uniform which improves the feed intake and digestibility of roughages.
- 2. Green chopping: When green roughages are chaffed, there is no need of soaking and fed as such or mixed with dry roughage or concentrate mixture.

Chemical treatment/processing

- Poor quality fodders are treated with chemicals such as sodium or potassium hydroxide and
- urea to increase the availability of the nutrients to livestock.
- Urea treatment: Urea treatment is most economical and easiest of all chemical treatments.
- 4 kg urea dissolved in 40 litres of water for 100 kg of straw.
- • Urea hydrolysis by urease: Ammonia= breakage of lignocellulose bond by ammonia thereby releasing cellulose from lignin bondage for digestion and utilisation.
- • After 21 days the urea treated paddy straw is ready for feeding available

Advantage

- increase the CP and TDN content from 2% to 10% and 45 to 60%,
- respectively. It improves the palatability of straw and thus, increases feed intake.
- • Feeding Urea treated Straw: It is not advisable to feed the urea treated straw (NPN
- substances) for calves below 6 months of age. For efficient use of urea treated straw, an
- adaptation period is required.
- • NaOHtreatment: 1.2-1.5% sol.→ Beckmann's method
- • Ca(OH)2 + NaOH: both 4%
- • 3% Anhydrous NH3: bind with sugar→4-methyl imidasol (Bovine bonker)

1. What is the main purpose of chopping or chafing roughages?

- a) To increase moisture content
- **b) To improve ruminal digestion by increasing surface area**
- c) To decrease feed bulk density
- d) To reduce the rate of fermentation

2. Which process involves treating straw with urea to release cellulose from lignin bondage for digestion?

- a) $Ca(OH)_2$ + NaOH treatment
- b) Pelleting
- **c) Urea treatment**
- d) Cubing/block and wafering

3. What is the disadvantage of finely grinding fodder plants for pelleting?

- a) Increased palatability
- **b) Reduced normal rumen functions and rumen pH**
- c) Increased mastication time
- d) Improved salivary secretion

4. Which method is most economical and easiest for chemical treatment of roughages?

- **a) Urea treatment**
- b) Sodium hydroxide treatment
- c) Potassium hydroxide treatment
- d) Anhydrous ammonia treatment

5. What is the purpose of white-rot fungi in biological processing of roughages?

- a) To increase moisture content
- b) To improve the palatability
- **c) To degrade lignin in lignocellulosic straws**
- d) To reduce the protein content

6. What temperature range is used for dehydration of roughages in a dehydrator?

- a) 600-1500°F
- b) 300-500°F
- c) 150-250°F
- **d) 100-200°F**

7. Which of the following fungi can degrade 65-75% of lignin in lignocellulosic straws?

- a) *Ganoderma applanatum*
- **b) *Phanerochaete chrysosporium***
- c) *Coprinus fimetarius*
- d) *Pleurotus spp*

8. In the Karnal process, what is mixed with urea-treated cereal straw before inoculating it with Coprinus fimetarius?

- a) Sodium hydroxide
- **b) 1% single superphosphate and 0.1% calcium oxide**
- c) Anhydrous ammonia
- d) Potassium hydroxide

9. Which processing method involves spraying water on roughages to soften the stem and improve palatability?

    - a) Grinding
    - **b) Soaking**
    - c) Baling
    - d) Cubing

3. Feeding Experiments

1.Comparative feeding trials

Two or more rations may be compared with growth and production.

For two rations, ‘t’ test is used

three or more rations ”analysis of variance” test is applied

2. Feeding trials with laboratory animals (like rats, mice, hamsters etc.)

- Low cost and the shorter time, easy

3. The purified diet method

A. Purified diets = lab animals.

B. purified sources of the various nutrients.

C. For example

- ★ Carbohydrates is supplied as starch, glucose or sucrose
- ★ Protein is supplied as Casein, Purified soybean, urea
- ★ Fat as lard or some oil
- ★ Minerals a chemically pure salts

Vitamins as pure crystalline compounds

3.3 Experimental designs

- Completely Randomized Design (CRD)
- Randomized Block Design (RBD)
- Latin Square Design (LSD).

1. CRD: Treatments are completely at random so that each experimental unit has the same chance of receiving any one treatment.
2. RBD: Experimental units are grouped into blocks, with the different treatments to be tested randomly assigned to the units in each block. Data analysis is simple and easy to understand.
3. LSD: Experiments to minimize the number of animals required to detect statistical differences.

Methods of determining digestibility

1. Live animal experimentation: *In-vivo* method
   - A. direct *in-vivo* method
   - B. indirect *in-vivo* method
     - by difference method
     - by indicator/ markers

2. Laboratory method:
   - *in sacco* / semi *in-vivo* method
   - *in-vitro* method

A. In-vivo methods:

1. Direct in-vivo method

a. **By digestion** – only feces collection – ruminants

b. **By metabolism trial** – feces and urine (and milk in milch animals) both collection - poultry

Norms of trials:

a. Animals: homogenous, four (minimum), male are preferred (collection of urine and feces easy)

b. Preliminary period: 7-14 days in ruminants and 2-5 days in pigs.

c. Collection period: 5-7 days (7-10 days sometime)

1. **Indirect in-vivo method:**

a. **By Difference:** difference of nutrient intake and fecal excretion is considered.

1. **Maintenance ration:** one trial is conducted. Ration that maintains constant BW is given and dig. is estimated.
2. **Productive ration:** 2 digestion trials (e.g. concentrate) are conducted.
    a. Trial 1 = (maintenance ration) and
    b. Trial 2 = (maintenance + production ration).
    c. So, Dig% = (Trial 2 – Trial 1).
3. **Non-maintenance ration :** 3 digestion trial (e.g. wheat straw)
    a. Trial 1 = (maintenance ration)
    b. Trial 2 = (maintenance + production ration)
    c. Trial 3 = (Non-maintenance + production ration)
    d. Dig% = Trial 3 - (Trial 2- Trial 1)

Drawback of difference method:

1. Associative effect of feeds:

Addition of productive ration (protein cake/ grains) may influence digestibility of basal/ maintenance ration or non-maintenance ration (wheat straw)

2. Digestibility in poultry:

- By surgical mean: separate urine and feces
- By chemical method: Urine N- uric acid and Fecal N – true protein

b. By Indicator/ markers: inert reference substance

- Ideal marker:
  - ➔ totally indigestible and non-absorbable
  - ➔ no pharmacological action on GIT (inert)
  - ➔ mix intimately and uniform distribution
  - ➔ uniform rate of pass through tract even a small amount of feces collected at any time gives an amount of nutrient per unit of marker.
  - ➔ voided completely
  - ➔ can be determined chemically in feces
  - ➔ natural constituent of feed – preferable

Indicator	
Internal	**External**
Natural constituent of feed	Not natural constituent of feed
Lignin	Chromic oxide (Cr_2O_3)
Silica	Ferric oxide
Acid insoluble ash	Radioactive isotopes: Cr51, Ce144

Estimation of Feed intake in grazing animals

Digestibility= internal indicator (lignin)

Fecal output= external marker (Cr_2O_3)

Chromic oxide capsule – fed and then sampling at different intervals to know avg. conc per unit of feces.

Feces output: Marker consumed (g/d)/Marker conc. (g/g feces)

Digestibility % = 100 - % Indigestibility = (intake – output/intake x 100)

Intake: (Output/% Indigestibility) x 100

B. Laboratory:

1. in sacco / semi in-vivo method/ in-situ technique

- Only ruminal digestion
- Fistulated animals: at least 3

a. Bag technique:

- Bag : nylon, dacron or silk – kept in rumen
- Important parameters of in sacco method:

    Bag size: 6.5 x 14 cm (may be larger)

    Porosity of bag: 40-60 µm

    Feed particle size: 1-2 mm

    Sample size to bag surface area: 10-20 mg/cm2

Limitation: effect of mastication, rumination and transit not considered

b. **VIVAR technique:** in-vivo artificial rumen.

Limitation of semi-in vivo method: effect of mastication, rumination and transit not considered.

Factors that affect the degradability of feed in nylon bag technique:

- Particle size- 1-2 mm screen.
- Bag porosity- 40-60 um
- sample size to bag surface ratio- 10-20 mg/cm2
- Diet of the animal
- Bags per animal
- Numbers of animals- 3 fistulated animals
- Positioning of bags in the rumen
- Incubation length-depend on the type of the feed
- Timing of bag introduction in the rumen and pre ruminal soaking

2. in-vitro rumen fermentation technique

1. One-stage technique: feed + rumen liquor + artificial saliva – 39oC / anaerobic condition
2. Two stage technique: 1st stage: rumen fermentation foregut digestion
   2nd stage: acid- pepsin solution hindgut digestion

Important Facts

- In-vitro gas production system : Menke and Steingass (1988) Menke's method
- Drawback: feed intake, palatability not considered
- Use of in-vitro rumen fermentation technique:
  : Rapid screening of large no. of samples
  : Evaluation of newer/ unconventional feeds

Drawback of in-vitro technique: feed intake, palatability and associative effects of feed ingredients not considered

1. Determination of digestibility of feed in following species is complicated: **UTTARAKHAND VO – 2024**

a) Cattle
b) Buffalo
c) Poultry
d) Swine

2. The collection period for digestibility trial of large ruminant should be (J&K 2012)

(A) 7-10 days
(B) 10-14 days
(C) 5-7 days
(D) 20-22 days

3. if an animal consumes 5 kg Dry matter and excretes 6 kg of feces with 50% moisture, the digestibility coefficient will be: PUNJAB 2016

a) 40%
b) 50%
c) 60%
d) None of the above

4. Which method is used to compare two rations in a comparative feeding trial?

- a) Analysis of variance (ANOVA)
- **b) t-test**
- c) Chi-square test
- d) Regression analysis

5. What is an advantage of using laboratory animals like rats or mice in feeding trials?

- a) Higher cost
- **b) Lower cost and shorter time**
- c) Difficult to slaughter
- d) Higher variability between animals

6. What is the source of protein in purified diets used for feeding trials with lab animals?

- **a) Casein**
- b) Lignin
- c) Glucose
- d) Minerals

7. In which experimental design are treatments assigned completely at random to experimental units?

- a) Latin Square Design (LSD)
- **b) Completely Randomized Design (CRD)**
- c) Randomized Block Design (RBD)
- d) Factorial Design

8. Which of the following methods involves collecting both feces and urine in metabolism trials?

- a) Feces collection method
- **b) Metabolism trial method**
- c) Bag technique
- d) VIVAR technique

9. What is the purpose of using chromic oxide as a marker in digestibility trials?

- a) It is a natural feed constituent
- b) It is completely digestible
- **c) It is indigestible and used as a reference substance**
- d) It has a pharmacological action on the digestive tract

10. In the in-sacco method for measuring digestibility, what is the recommended porosity of the nylon bag?

- a) 10-20 µm
- **b) 40-60 µm**
- c) 80-100 µm
- d) 100-150 µm

Classification of feeding standards

Feeding standards		
A. *Comparative type*	**B. *Digestible- Nutrient system***	**C. *Production-value type***
Compare different feeds to a standard one	**Feeding based upon digestible portions of nutrients in different feed.**	**Based upon efficiency of feed to increase productivity.**
1. Hay standard 2. Scandinavian feed Unit" Standard	1. Grouven's Feeding standard 2. Wolff's feeding standard 3. Wolff's Lehmann feeding standard 4. Haeckers's Feeding standard 5. Savage feeding standard 6. Morrison standard 7. National Research Council standard 8. Indian standard	1. Kellner-feeding standard 2. Armsby feeding standard 3. Agricultural and Food Research Council standard.

A. COMPARATIVE TYPE

1. **Hay standard:** by Thaer In 1810

- Different feeds should be compared using **meadow hay** as a unit.
- The only measure was the practical feeding experience.

2. **Scandinavian "feed unit" standard: By** Professor Fjord In 1884

- only the feed **unit** was taken.
- The value of one pound of common grain such as corn, barley or wheat, is given as one unit value and the value of all other foods is based upon this.

B. DIGESTIBLE NUTRIENT SYSTEM

1. **Grouven's feeding standard**

- with **crude protein, carbohydrates and fat**

2. **Wolff's feeding standard: by** Dr. Emil Von Wolff In 1864

- Based on **digestible protein, digestible carbohydrates and digestible fats**.
- This standard is an improvement over the standard of Grouven,
- It does not consider the quantity and quality of milk produced.

3. **Wolff's Lehmann feeding standard:**

quantity of milk produced, but not quality of milk.

4. **Haecker's feeding standard**

- First time considered **quantity as well as the quality of milk**
- First to separate the requirements for maintenance from the requirements of production.
- included digestible crude protein, carbohydrates and fats.
- Later it was expressed in digestible crude protein and total digestible nutrients.

5. Savage feeding standard

- Based on nutritive ration
- The **nutritive ratio** should not be wider than 1:6 or narrow than 1:4.5.
- About two-thirds of the dry matter should be from the roughages and one-third from the concentrates.

Nutritive ratio: NV = DCF + DNFE + (DEEx2.25) / DCP = TDN – DCP/ DCP

Where, TDN= DCF+DCP+DNFE+ (DEEx2.25)

- Protein rich feeds: Narrow NV e.g. protein cakes.
- Poor protein feeds: wider nutritive ratio e.g. roughages.

6. **Morrison feeding standard**

expressed in terms of **Dry Matter (D.M.), Digestible crude Protein (DCP) and (TDN).**

- **net energy values instead of TDN** in computing rations were also included.
- allowances for calcium, Phosphorus and Carotene
- accepted for Indian livestock.

7. **National Research Council (NRC) standard:** includes **digestible protein and total digestible nutrients (TDN)**

- Also **requirements for calcium, phosphorus, carotene and vitamin D** for most animals.
- They use ME for poultry, DE for swine and horses, DE, ME and TDN for sheep, ME, TDN and NE*m* and NE*g* for beef cattle and for dairy cattle

8. **Indian standards**

- Sen and Ray standards**:** he adopted the **average of maximum and minimum values recommended by Morrison**.
- **Indian Council of Agricultural Research**
- **C. PRODUCTION VALUE TYPE**

1. Kellner feeding standard

Based upon **“Starch” as a standard unit of measurement (Starch equivalent)**.

2. Armsby feeding standard

- Based on **true protein and net energy** values.

3. Agricultural Research Council (ARC) standard: requirements of poultry, ruminants and pigs.

- Followed in the United Kingdom. .

1. Feeding standards do not consider **JKPSC-2020**

A) Production Level of Livestock
B) Nutrients Requirement of Livestock
C) Nutritive Value of Feed Ingredients
D) Economics of Livestock Production

2. Starch equivalent system is based on **JKPSC-2020**

A) NE & Digestible True Protein
B) DCP, TDN & NE
C) DCP & TDN
D) DM,DCP & TDN

3. Who developed the starch equivalent value of feed **JKPSC - 2019** 2019

(A) Atwater
(B) Morrison
(C) Armsby
(D) Kellner

5. Which one of the following is the Digestible-Nutrient system type feeding standard? RPSC 2019

(1) Hay standard
(2) Armsby feeding standard
(3) Scandinavian "Feed unit" standard
(4) Morrison standard

6. Starch equivalent based energy system was given by Rpsc 2013

(1) Morrison

(2) Armsby

(3) Kellner

(4) Dubois

7. In 1890, a feeding standard based on the "available fuel values of the feeds" was proposed by Mppsc 2021

(A) Armsby

(B) Atwater

(C) Kellner

(D) Lehmann

8. Wolff-Lehman feeding standard developed in the year: Opsc 2013 -14 2nd

(a) 1903

(b) 1896

(c) 1884

(d) 1907

5. Conservation of Feed through Silage and Hay

- There are two methods of conserving forages;

1. Reduce moisture content- Hay

2. Maintain moisture content:

   Natural fermentation is facilitated to retain succulence- silage

Silage

Anaerobic fermentation of the green fodder crop retaining the high moisture content. It contains 25-35% DM & 14-16% CP.

process - ensiling.

Selection of crops for silage making:

- Thick stems
- High level of fermentable sugar
- Low protein like maize, sorghum, bajra etc.
- **Crop** should have 35 % dry matter or 60-70% moisture at the time of ensiling.
- Legumes are avoided
- harvested between flowering and milk stage

Method of Silage making

- A silo which is an air tight structure for storage and preservation.
- One cubic meter space is required for 400kg fodder silage making.
- Chopping of forage to a short length (1-3 cm).
- Compact forage as tightly as possible.
- Sprinkle salt at 0.5%, urea 1% and molasses 3% of the material weight to improve sugar content.
- Maintain sealing for 45 days.

Types of fermentation during Silage formation

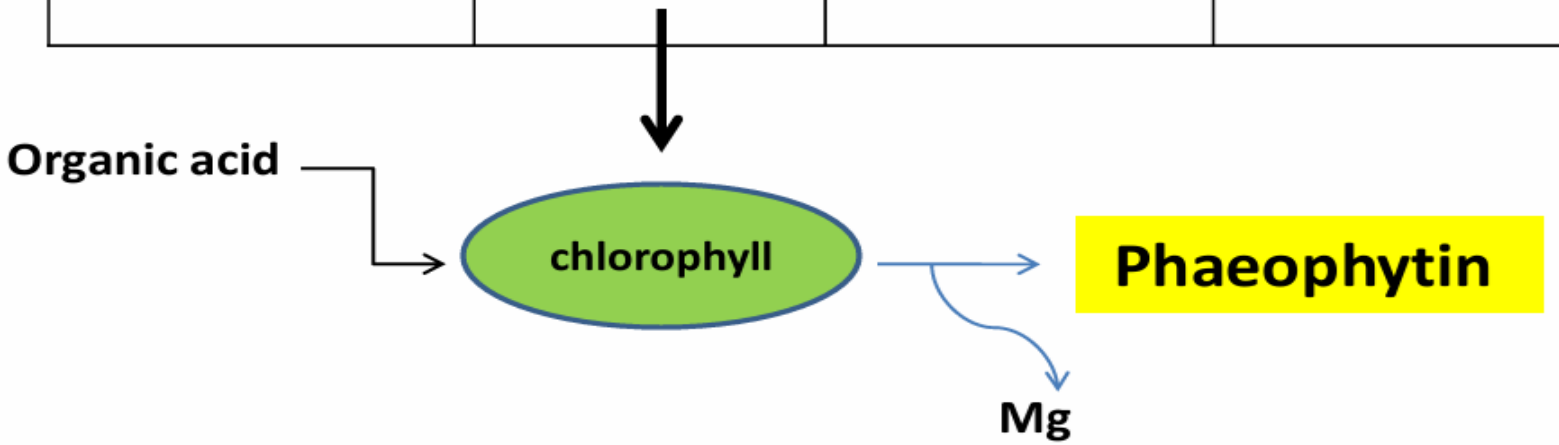
Lactic acid type- Desirable forage is carbohydrate rich.

Butyric acid type- When forage contains more protein than clostridium bacteria grow and deteriorate its quality.

Flieg index is used to evaluate silage quality which measures butyric acid produced. Lesser the butyric acid better will be silage quality.

Silage quality- Flieg index (butyric acid)

parameters	Very Good	Good	Fair	Poor
Butyric acid	Absence	Traces	Little	High
pH	3.8-4.2	4.2-4.5	4.5-4.8	>4.8
Ammonia Nitrogen	<10%	10-15%	15-20%	>20%
Colour	Greenish brown	Brownish	Tobacco brown	Blackish



Hppsc 2017, VMO

Hay

Hay: dried green-fodder material

Reducing the moisture content of the green crop to a level low enough (12%-14%) to inhibit the action of plant and microbial enzymes is the aim of hay making.

Hay - free from moulds.

The harvested crop can be dried either by natural drying or through artificial drying.

Natural drying is preferred: It can be done without incurring expenditure towards electricity

Average quality hay will have 25-30 per cent crude fibre and 45-60 per cent TDN.

Crops for good hay

Selection of crop –

- The crop to be made as hay should have soft pliable, hollow stem.

Harvesting of crop –

- The nutritive value of hay depends on the stage of growth of the crop at the time of cutting.
- The crop should be harvested at 2/3rd flowering stage as it is at that time the plant will have the maximum nutrient in it.
- Delaying the harvesting further would divert the nutrients from the plant to seed production resulting in low nutritive value of the harvested crop.

HARVESTING AND CURING OF HAY

Good quality hay can be produced by harvesting the crop early in the morning and left in the field as such for curring.

Mechanical damage: Handling hay during early morning minimized loss of leaves.

Dry until the moisture content is reduced to about 14%.

Frequent turning is necessary to facilitate uniform drying.

On sunny days field drying of harvested crop for two days is sufficient to make hay.

Hay should always be stored in well ventilated place as they catch fire easily.

Methods

Field curing- sun

Barn drying: fan/ air duct

Artificial drying-hot air-expensive

Hot air (150°C) for 20-50 minutes.

Hot air (500-1000°C) for 0.5-2 minutes.

Types of hay

Legume hay: higher TDN and DCP and are rich in protein & minerals. Crops –Lucerne, Cowpea, Berseem. Good quality hay.

Non legume hay: less palatable and less amount of protein, vitamin and nutrients than legume hay but rich in carbohydrates. Crops – Oat, barley, Bajra, sorghum and grasses.

Mixed hay: The nutritive value of mixed hay depends upon the type of legume and non legume crops.

Losses in nutritive value of hay

Losses due to late cutting

Losses of leaves by shattering

Losses due fermentation

Losses due to leaching

Losses due to bleaching- green material **(HPSC-2018)**

Loss of DM	**20-30% in legumes** **10-15% in grasses**
Loss of protein	**28%**
Loss of carotene	**90%**
Loss of energy	**25%**

Difference in silage and Hay

Particular	Silage	Hay
DM (%)	30-35	10-15
Type of crop	Non leguminous type. Maize,jowar,sorghum, bajra	Leguminous type Lucerne, oats berseem
Texture OF CROP	Thick stemmed, carbohydrate rich	Thin stemmed, protein rich
Method utilised	Fermented product	Sun dried product
Losses of nutrients	less	more
Time of harvest of crop	between flowering and milk stage	2/3rd flowering stage
digestibility	Partially digested during fermentation so more digestible	Not digested during drying. Less digestible.
Drying	Crop is not dried and used after cutting only	it is dried first
Air	Complete exclusion of air	Openly dried in air

- **Haylage (hay+silage):** Dry matter in crops used for haylage making is 40-45%.

- **Wastelage:** Anaerobically fermented animal waste like poultry droppings, poultry litter, swine excreta and bovine dung along with other feed ingredients with the help of lactic acid producing bacteria.

- **Oat hay poisoning/ nitrate poisoning**: Nitrate poisoning can occur in crops like sorghum, lucerne, and Sudan grass. In the rumen, nitrate is reduced to nitrite, which, when absorbed into the bloodstream, oxidizes the ferrous ion in hemoglobin to ferric ion, forming methemoglobin. This causes the blood to become chocolate brown, leading to a brownish discoloration of the mucous membranes and skin.

1. Which fodder crop is most suitable for silage production?
PUNJAB 2022

a) Berseem
b) Lucerne
c) Lobia
d) Maize

2. The pH range of good quality silage is RPSC 2019

(1) 3.5-4.2
(2) 3.2-3.5
(3) 4.2-4.5
(4) 4.5-4.8

3. Silage is Punjab 2021

(A) Preserved dry fodder
(B) Fermented fodder
(C) Succulent fodder
(D) none of above

4. Very good silage should have pH ranging from Rpsc 2013

(1) 4.2 to 4.5
(2) 4.5 to 4.8
(3) 3.7 to 4.2
(4) 4.8 to 5.0

5. Best crop suitable for silage making is Rpsc 2013

(1) Jowar
(2) Bajra
(3) Maize
(4) Oats

4. Very good silage should have pH ranging from Rpsc 2013

(1) 4.2 to 4.5
(2) 4.5 to 4.8
(3) 3.7 to 4.2
(4) 4.8 to 5.0

5. Best crop suitable for silage making is Rpsc 2013

(1) Jowar
(2) Bajra
(3) Maize
(4) Oats

8. Following is the 'best quality hay' for feeding of sheep: Opsc 2013 -14 2nd

(a) Lucerne hay

(b) Grass hay

(c) Mixed grass hay

(d) Guinea grass hay

9. The acid required for good quality silage is: Opsc 2013 -14 2nd

(a) Acetic acid

(b) Butyric acid

(c) Propionic acid

(d) Lactic acid

10. Moisture content of chopped hay is: Opsc 2013 -14 2nd

(a) 19-22%

(b) 25-28%

(c) 20-25%

(d) 25-30%

11. The pH of good silage is: Opsc 2013 -14 2nd

(a) 7

(b) 4

(c) 6

(d) 3.5

Unit 5

Nutrient Requirements and Ration Formulation

1. Balanced Ration and Its Characteristics
2. Nutrient Requirements and Methods
3. Feeding Practices for Cattle and Buffalo
4. Feeding Practices for Sheep and Goat
5. Use of NPN compounds in livestock feeding

1. Balanced Ration and Its Characteristics

Ration

A ration is the feedstuff offered for a given animal during a time period of 24 hours. The feedstuffs are give at a time or in proportions at intervals (diet)

A balanced ration is one that furnishes nutrients in such proportions and amount that it will properly nourish a given animal for 24 hours

Method of Ration Formulation

1. Pearson Square Method
(Single and double Pearson Square Method)
2. Algebraic Method
3. Thumb Rule Method
4. Linear Programming or Least-cost Feed Formulation or Computer Method
5. Hit and Trial Method

Computer-Formulated Rations: 'Least cost' ration/ Linear Programming:

'Least cost' ration:

- If a ration is balanced using a combination of ingredients with the lowest possible total cost, the resulting mixture is called a "least cost" ration.
- Linear Programming is the technique employed to calculate least- cost and profit-maximizing rations

Computation steps:

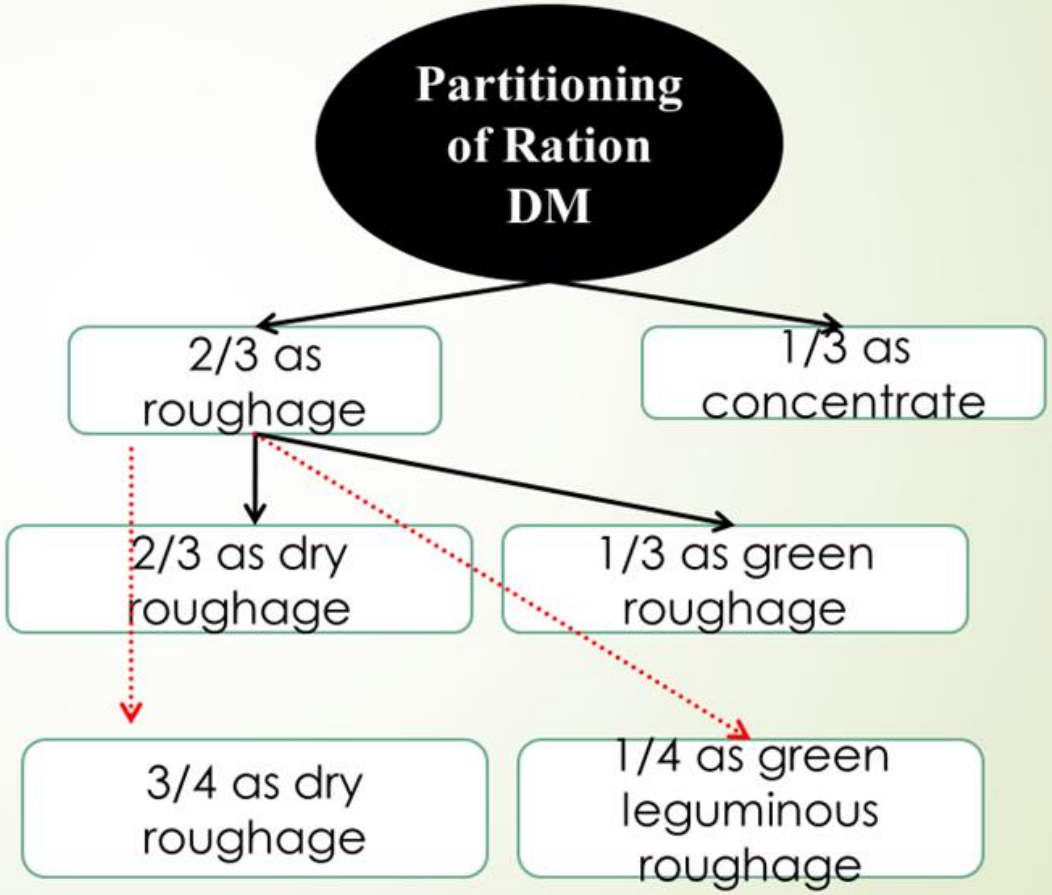
DMI calculation

Nutrient requirement calculation

Balance with available ingredient

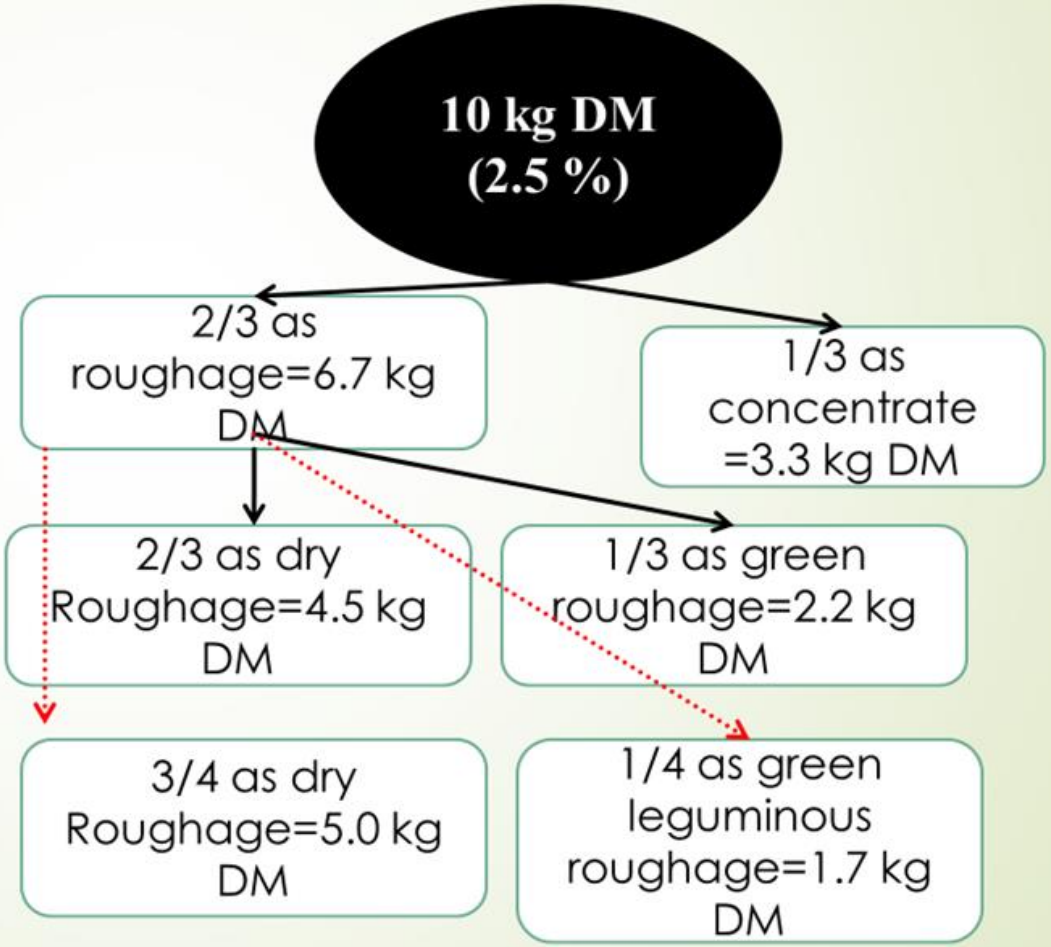
DMI Calculation

- DM requirement in indigenous cattle is 2-2.5 kg/100 kg BW (2-2.5 %).
- DM requirement in buffalo/crossbred cattle/exotic cattle is 2.5-3.0 kg/100 kg BW (2.5-3.0%).



Question: Calculate DM from different components of ration for a 400 kg Gir cow?

- DM requirement in indigenous cattle is 2-2.5 kg/100 kg BW (2-2.5 %).



1) A method of determining the least-cost ration using a series of mathematical equations.
JKPSC-2020

A) Pearson Square method
B) Algebraic method
C) Linear Programming
D) Two by Two Matrix method

2) Arrange the following activities stepwise in formulation of ration for dairy cattle **JKPSC-2020**

1) Calculate nutrient requirements of animal according to its production
2) Choose available feed ingredients
3) Manipulate each ingredient to match the supply and requirement of nutrients
4) Know the nutrient content and inclusion levels of feed ingredients
5) Calculate the nutrients supplied by a set weight of feed ingredients

A) 1,2,4,5,3
B) 2,4,1,3,5
C) 1,2,5,3,4
D) 4,2,5,1,3

3. Which technique is employed in computer analysis to calculate least cost ration? Uppsc 2022

a. Linear programming
b. Nonlinear programming
c. Curvi-linear programming
d. Integer-linear programming

4. Consider the following statement regarding ration formulation: **JKPSC - 2019**

1) Age, Pregnancy, milk Product and Physical activity must considered when formulating ration

2) It should contain all essential vitamins and minerals

3) It should contain balance of protein carbohydrates and fats

Which of the statements given above are correct?

(A) 1 and 2 only

(B) 1 and 3 only

(C) 2 and 3 only

(D) 1, 2 and 3

5. The collection period for digestibility trial of large ruminant should be (J&K 2012)

(A) 7-10 days

(B) 10-14 days

(C) 5-7 days

(D) 20-22 days

6. The technique employed to calculate least cost and profit maximizing rations is called as Mppsc 2019

(A) Trial and Error method

(B) Pearson's Square method

(C) Linear Programming

(D) Algebraic method

9. For determining the digestibility of a feed by conducting digestion trial in ruminants, the optimum length of 'preliminary period' followed is: Opsc 2013 -14

(a) One week

(b) Two weeks

(c) Three weeks

(d) 60 days

10. The amount of feed an animal needs to maintain its body mass and composition without any weight loss or gain: Opsc 2021-22

(A) Balanced ration

(B) Ideal ration

(C) Maintenance ration

(D) Production ration

11. The feed allowed for a given animal during a day of 24 hours is called as Mppsc 2021

(A) Ration

(B) Diet

(C) Balanced feed

(D) Complete feed

2. Nutrient Requirements and Methods

A. Energy Requirement For Maintenance

Rubner: BMR varies with body size = metabolic body size = surface area law

•Scaling Exponents:While Rubner initially suggested a scaling exponent of 2/3 for the relationship between metabolic rate and body mass, subsequent studies (notably by Max Kleiber) found a scaling exponent closer to 3/4. This ongoing debate highlights the complexity of metabolic scaling across different species

For dairy cattle and buffalo:

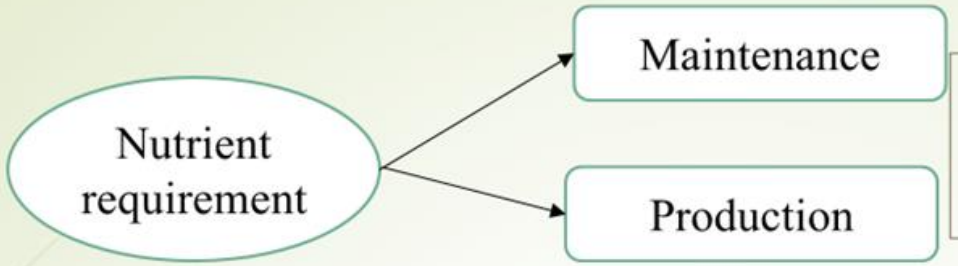
- NEm = 80 W0.75 (Kcal/day)
- MEm = 133 W0.75 (Kcal/day)
- TDNm = 35.2 W0.75 (g/day)

B. Protein Requirement For Maintenance

1. Feeding trial = minimum dietary protein to maintain body weight
2. Nitrogen balance method- equilibrium = minimum constant N-output
3. Factorial method = EUN+MFN

EUN mg/day = 146 W0.72 kg = Function of Body size

- Indian cattle = 0.020 g/kg BW
- Bos taurus = 0.289 g/kg BW
- Metabolic fecal nitrogen = MFN = Function of DMI
- Indian cattle = 0.35 g/100 g DMI
- Buffaloes = 0.34 g/100 g DMI



"Nutrient requirements of cattle and buffalo" (ICAR-2013)

Maintenance Requirement of cattle and buffalo

Body weight (kg)	DM (kg/day)	TDN (kg/day)	ME (Mcal)	CP (g/day)	Ca (g/day)	P (g/d)
400	8.64	3.27	11.82	436	18	8
450	9.72	3.58	12.94	476	20	9
500	10.8	3.88	14.04	515	23	10
550	11.88	4.18	15.10	553	25	11
600	12.96	4.47	16.15	591	27	12

Milk Production Requirement

Fat%	DM (kg/day)	TDN (kg/day)	ME (Mcal)	CP (g/day)	Ca (g/day)	P (g/d)
Cow						
4	0.510	0.330	1.20	96	3.2	1.8
Buffalo						
6	0.670	0.440	1.58	124	4.8	1.8

- Calculate nutrients requirement of a Sahiwal cow with 450 kg body weight and yielding 10 kg of milk having 4% milk fat?

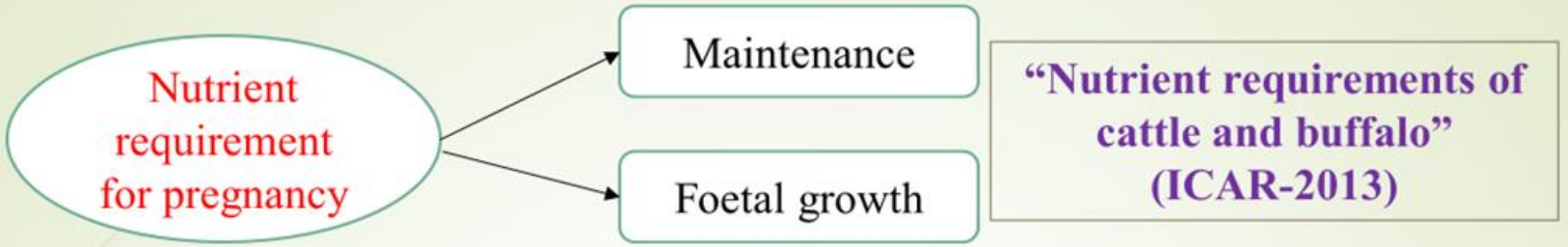
- Maintenance nutrients requirement of a Sahiwal cow with 450 kg body weight

Body weight (kg)	DM (kg/day)	TDN (kg/day)	ME (Mcal)	CP (g/day)	Ca (g/day)	P (g/d)
450	9.72	3.58	12.94	476	20	9

- Nutrients requirement for milk production (4% milk fat)

Fat%	DM (kg/day)	TDN (kg/day)	ME (Mcal)	CP (g/day)	Ca (g/day)	P (g/d)
Cow						
4	0.510	0.330	1.20	96	3.2	1.8

Body weight (kg)/fat %	DM (kg/day)	TDN (kg/day)	ME (Mcal)	CP (g/day)	Ca (g/day)	P (g/d)
Maintenance requirement						
450	9.72	3.58	12.94	476	20	9
Milk production						
For 1 kg milk with 4% fat	0.510	0.330	1.20	96	3.2	1.8
For 10 kg milk with 4% fat	5.10	3.30	12.0	960	32	18
Total						
	14.82	6.88	24.94	1436	52	**27**



Cow-Foetal growth

Month of gestation	DM (kg/day)	TDN (kg/day)	ME (Mcal)	CP (g/day)
6-7	0.85	0.64	2.30	169
7-8	0.99	0.74	2.67	216
8-9	1.13	0.84	3.05	263
Ca (upto 190 days=1 g/day; 190 days onwards=10 g/day)				
P (upto 190 days=1.5 g/day; 190 days onwards=6 g/day)				

Buffalo-Foetal growth

Month of gestation	DM (kg/day)	TDN (kg/day)	ME (Mcal)	CP (g/day)
6-7	1.0	0.80	2.76	203
7-8	1.2	0.90	3.21	259
8-9	1.4	1.0	3.66	316
9-10	1.5	1.1	4.11	373
Ca (upto 190 days=1 g/day; 190 days onwards=10 g/day)				
P (upto 190 days=1.5 g/day; 190 days onwards=6 g/day)				

2. Nutrient requirement for 7.5 months pregnancy

Month of gestation	DM (kg/day)	TDN (kg/day)	ME (Mcal)	CP (g/day)
7-8	0.99	0.74	2.67	216
Ca (190 days onwards=10 g/day)				
P (190 days onwards=6 g/day)				

DM (kg/day)	TDN (kg/day)	ME (Mcal)	CP (g/day)	Ca (g/day)	P (g/day)
10.71	4.32	15.61	6.92	29	15

Nutrient requirement for growth

"Nutrient requirements of cattle and buffalo" (ICAR-2013)

BW (kg)	Weight gain (kg/day)	DM (kg/day)	TDN (kg/day)	ME (Mcal)	CP (g/day)	Ca (g/day)	P (g/day)
70	0.2	1.6	1.04	3.76	263	<200 kg BW = 17	Young = 9
70	0.3	1.8	1.16	4.19	335		
70	0.4	1.8	1.28	4.63	406	200-300 kg BW =13	
100	0.2	2.9	1.33	4.78	288		
100	0.3	2.9	1.46	5.28	357		Adult=6
100	0.4	3.0	1.61	5.80	423	>400 kg BW = 8	
100	0.5	3.1	1.75	6.32	487		
100	0.6	3.1	1.90	6.84	549		

1. Read the following statements : **MPSC – 2019**

a. Energy is the most important nutrient to produce milk.

b. The energy needed depends upon the composition of milk.

Now state whether :

(1) Both the statements are correct

(2) Statement a is correct, but statement b is not correct

(3) Statement b is correct, but statement a is not correct

(4) Neither of the statements is correct

2. Dry matter intake of dairy animals should be Uppsc 2022

(a) 1% of body weight per day

(b) 0.5% of body weight per day

(c) 4% of body weight per day

(d) 10% of body weight per day

3. The dry matter requirement for cattle per 100 kg body weight is **Kerala PSC – June 2023**

a) 1.5 - 2.0 kg

b) 2.5 - 3.0 kg

c) 2.0 - 2.5 kg

d) 3.0 - 4.0 kg

4. Dry matter requirement for a cow weighing 400 kg, giving 10 liters of milk having 4-5% fat is **MPPSC 2023**

[A] 2 kg
[B] 4 kg
[C] 10 kg
[D] 20 kg

5. Maintenance D. M. total requirement of 400 kg crossed breed cows require: **OPSC 2018-2019**

(A) 5-7 kg
(B) 8-10 kg
(C) 11-13 kg
(D) 13-15 kg

3. Feeding Practices for Cattle and Buffalo

Feeding of calves

Best feeding practice for rearing a calf is to start feeding from the last **trimester of pregnancy** then in the pre-ruminant **period** and **post ruminant period**

- Colostrum: within 2 hours @ 1/10th BW (17% protein, IgM, IgA, IgG)

Importance of Colostrum feeding

- Provide passive immunity
- Laxative effect hence avoid constipation
- Excellent source of Vit A, D, & E

FEEDING SCHEDULE OF COW CALVES (0-3 months): WHOLE MILK+ SKIM MILK+ CALF STARTER

Age(days)	Colostrum (lit)	Milk(lit)	Skim milk(lit)	Calf starter(g)
1-3	$1/10^{th}$ B.wt	-	-	-
4-7		$1/10^{th}$ B.wt		-
8-14		$1/10^{th}$ B.wt		-
15-21		$1/10^{th}$ B.wt		Little
22-35	-	$1/15^{th}$ B.wt	-	100
upto 60 days		$1/20^{th}$ B.wt	$1/25^{th}$ B.wt	250
61-90		$1/25^{th}$ B.wt	$1/15^{th}$ B.wt	500

Calf starter-

- solid feed consisting of ground grains, oil cakes, animal protein supplement, brans, dried skim milk, soymeal, whey, mineral mix, and butyrate.
- For accelerated growth and early weaning of the calves.
- **contain 23-26% CP, 18-19.5% DCP and 75% TDN**
- Started at 7-10 days (14 days)
- for proper rumen development

Challenge feeding/steaming up

- Feeding/supplying extra nutrient in high yielding animals to challenging them to produce at their maximum potential is known as challenge feeding.
- Challenge feeding starts 2 weeks prior to the expected date of calving.
- Feeding of extra concentrate at 500 g/day and increase it gradually to a level of 500-1000 g/day/100 kg BW.
- Challenge feeding will condition digestive system for the increased quantity of feed to provide sufficient nutrients to initiate lactation on a higher plane.

Thumb rule

Feed stuffs	Zebu / indigenous cow	Crossbred cow/ buffaloes
Straw	4.00 kg	4.00-6.00 kg
Concentrates mix		
Maintenance	1.25 kg	2.00 kg
Pregnancy (last trimester)	1.25 kg	1.75 kg
Lactation	1.00 kg/ 2.5 kg MY	1.00 kg/ 2.0 kg MY

- 1 kg Concentrate mix = 10 kg green fodder
- Concentrate mixture = 20% CP, 65% TDN, 0.5-0.7% Ca and 0.3-04% P

BIS SPECIFICATIONS FOR COMPOUNDED FEEDS FOR CATTLE

S.No.	Characteristic Requirement	Type 1	Type 2
1	Moisture (max)	11	11
2	Crude protein (min)	22	20
3	Crude fat (min)	3.0	2.5
4	Crude fibre (max)	7	12
5	Acid insoluble ash (max)	3.0	4.0

NUTRIENT COMPOSITION OF COMMON FEEDSTUFFS

Ingredient	ME (Kcal/kg)	CP (%)	CF (%)	EE (%)	Ca (%)	P (%)
Maize	3309	9.2	3.0	3.8	0.25	0.40
Bajra	2950	12.7	4.0	3.0	0.13	0.72
Rice polish	2837	12.7	12.0	16.0	0.27	1.37
Wheat bran	1286	17.2	10.9	3.0	0.19	1.12
Soybean meal	2300	45.0	6.0	1.0	0.36	0.90
Groundnut ext.	2128	40-42	11.2	1.0	0.31	0.67
Fish meal	1834	43.1	2.5	6.0	7.16	2.5

Feeding high yielders:

- Energy: Feeding bypass fat
- Protein: Feeding bypass protein

  UDP = 8% of total diet protein%
- Fiber: 28-32% NDF
- Mineral mixture: 10g MM/ kg of milk production.
- Challenge feeding: steaming up (2 weeks prior to calving)

DCAD salt in pre-partum transition period = (-100 to -140 meq/kg DMI) maintain Ca homeostasis and help in avoiding milk fever

1. Crude protein and TDN content of calf starter should be **MPPSC 2022**

(1) 23 - 26 %, 75% (3) 13 -15 %;. 70 %

(2) 18 - 20 %, 70% (4) 6 - 8 %, 75 %

2. In high yielding animals, the important amino acid source for post rumen digestion is now considered as **MPSC 2011**

(1) Microbial protein (2) Microbial protein-non-ammonia-N

(3) Undegradable protein **(4) All the above**

4 Calf reared on milk in first and second week requires milk in amount: **UTTARAKHAND VO – 2024**

a) 1/10 body weight

b) 1/15 body wight

c) 1/20 body weight

d) 1/25 body weight

5 . The amount required as dry roughage (with sufficient legumes) for a cross bred cow weighing 400 kg is **JKPSC - 2019**

(A) 10 kg
(B) 6.5 kg
(C) 3.5 kg
(D) 4.9 Kg

7. From which day of age 'Hay' can be given to newborn calves ? Uppsc 2022
(a) 10th day
(B) 155 day
(c) 20th day
(d) 1 month

8. According to the thumb rule, 1 kg of concentrate mixture is required for every kg of milk yield in cows. Opsc 2013 -14
(a) 2.0
(b) 2.5
(c) 3.0
(d) 1.5

9. What should be the recommended crude protein content (%) in calf starter? PUNJAB 2022

a) 5
b) 10
c) 15
d) 22

10. Colostrum is fed to calves at the rate of RPSC 2019

(1) 20% of BW
(2) 15% of BW
(3) 10% of BW
(4) 5% of BW

11. Feeding colostrum within first two hours of the birth of new born is essential because **RPSC 2019**

(1) It is iron rich.
(2) It is Vitamin B Complex rich.
(3) It is rich in copper.
(4) Immunoglobulins

12. New born calf should get first colostrum from its dam within **PUNJAB 2021**

(A) 30 minutes after birth
(B) 12 hours after birth
(C) 24 hours after birth
(D) 48 hours after birth

4. Feeding Practices for Sheep and Goat

Comparative feeding behavior and digestive physiology in goats and sheep

Sno.	Characteristics	Goats	Sheep
1	Activity	Walk longer distance	Walk shorter distance
2	Feeding pattern	Browser, more selective	Grazer, less selective
3	Variety in feed	preferential	Less preferential
4	Salivary secretions	Greater	Lesser
5	Recycling of urea in saliva	Greater	Lesser
6	DMI for Meat	3%of BW	3%of BW
7	DMI for lactation	4-6% of BW	3%of BW
8	Digestion of coarse roughage Higher	Higher	less
9	Retention time	Longer	Shorter
10	Water intake/unit DMI	Lower	Higher

Dry Matter Intake:

- DMI = 70 g /kg $W^{0.75}$ (3.2% of BW)
- Meat goats: 3% of BW
- Dairy goats: 4-6% of BW

Maintenance:

- ICAR has taken 76 g/kg $W^{0.75}$ as DMI
- Nutrient requirement per kg metabolic body size are DCP 3.0 g and TDN 30 g

BW (kg)	DMI (g)	DCP (g)	TDN (g)	Ca (g)	P (g)
15	500	23	240	1.1	0.7
25	730	34	350	1.6	1.1
35	940	44	450	2.1	1.4
45	1125	53	540	2.5	1.7
55	1315	62	630	2.9	1.9

Growth:

For Growth- DCP req 0.34 g/g BW gain, TDN- 1.61g/g gain

BW (kg)	ADG (g)	DMI (g)	DCP (g)	TDN (g)
15	50	510	33	330
	100	645	43	420
	150	785	53	510
25	50	760	44	440
	100	915	54	530
	150	1070	64	620

Pregnancy

1.For pregnancy:

- DMI-92 g/kg W $^{0.75}$
- DCP requirement -5.55 g/kg W $^{0.75}$
- TDN requirement is -50.5 g /kg W $^{0.75}$

BW (kg)	DMI (g)	DCP (g)	TDN (g)	Ca (g)	P (g)
15	700	42	385	2.1	1.4
25	1025	62	564	3.1	2.1
35	1320	80	725	4.0	2.7
45	1590	96	875	4.8	3.2
55	1850	112	1018	5.5	3.7

2. For Lactation

- DCP requirement -45 g/kg FCM Over and above maintenance req
- TDN requirement is 345 g /kg FCM Over and above maintenance req
- FCM (3.5% fat): [(0.35 ×kg of milk) + (18.57 x kg of fat)]

BW (kg)	Milk yield (kg)	DMI (g)	DCP (g)	TDN (g)	Ca (g)	P (g)
25	0.5	968	56	523	4.8	3.2
	1.0	1290	79	695	6.4	4.3
35	0.5	1155	66	623	5.8	3.9
	1.0	1470	89	795	7.3	4.9
45	0.5	1320	75	713	6.6	4.4
	1.0	1640	98	885	8.2	5.3
55	0.5	1490	84	803	7.4	4.9
	1.0	1805	107	975	9.0	6.0

Feeding of Kids

- within 1 hour the kids should get colostrum continued for 3 days.
- After the 3rd day up to weaning, feed them with milk at 2 to 3 times a day ($1/6^{th}$ BW up to 1 month and then $1/8^{th}$ of BW in the 2nd month and 1/10th-$1/12^{th}$ BW during the 3rd month).
- At 1 month of age: Young ones should be provided with concentrate mixture (starter feed)

Creep Feeding

- for nursing kids for rapid growth
- accelerated growth or early weaning management program
- palatable and easily digestible concentrate mixture
- If grasses and cereal fodder—DCP 18% & TDN 75%
- If leguminous fodder –DCP 12% and TDN 70%
- Offer feed @ 50-100gm/animal/ day, and as gradually they eat more, reduce the milk allowance.
- Creep feed started from 10^{th} day up to 90 days of age or pre-weaning period for faster gain

Feeding Schedule for a Kid from Birth to 90 days

Age of kids	Dam's milk or cow milk (ml)	Creep feed (g)	Forage, green/day (g)
1-3 days	Colostrum 300 ml, 3 feedings	-	-
4-14 days	350 ml, 3 feedings	-	-
15-30 days	350 ml, 3 feedings	A little	A little
31-60 days	400 ml, 2 feedings	100-150	Free choice
61-90 days	200 ml, 2 feedings	200-250	Free choice

FEEDING OF SHEEP

Maintenance

- DCP: 2.97g / kg $W^{0.75}$
- TDN: 27.3 g / kg $W^{0.75}$

- **Nutrient Requirement for Maintenance**

BWt	DCP (g)	TDN (g)
20	28	258
40	48	434
60	65	588

DM requirement- 3.0-3.5% Bwt, DMI decrease as the animal matures

Flushing:

•The practice of increasing the nutrient intake of ewes and improving body condition prior to and during breeding.

•In this 25% more nutrients above maintenance needs has to be given 2-3 weeks prior to breeding season
Purpose – to increase ovulation rate and hence the lambing rate

Pregnancy:

- Nut req slowly increases during first 15 weeks of pregnancy as embryo grows and req during final 6 weeks of pregnancy are elevated.

- Breeding ram and pregnant ewes (last 6 weeks) should be provided with 50% more nutrients than the maintenance needs.

Nutrient Requirement for Pregnancy

BW (kg)	DCP (g)	TDN (g)
25	80	580
45	135	903
60	155	1121

1. What is the recommended milk feeding schedule for kids during the 2nd month of age?

a) 1/6th BW

b) 1/8th BW

c) 1/10th BW

d) 1/12th BW

2. At what age should kids be provided with a concentrate mixture (starter feed)?

a) At birth

b) 2 weeks

c) 1 month

d) 90 days

3. What is the purpose of creep feeding in kids?

a) To reduce milk intake

b) To promote rapid growth and rumen development

c) To reduce forage intake

d) To replace milk completely

4. What is the DCP requirement for a finisher goat?

a) 10%

b) 5-6%

c) 7-8%

d) 12%

5. How much concentrate mixture should a lactating goat producing 2 liters of milk be given?

a) 200 g

b) 300 g

c) 400 g

d) 500 g

6. Which amino acid is the first limiting for wool growth and weight gain in sheep?

a) Methionine

b) Lysine

c) Arginine

d) Cysteine

7. When should flushing be done for ewes/does?

a) During early lactation

b) 2-3 weeks before breeding

c) After weaning

d) At the end of pregnancy

8. What is the DMI requirement for meat-producing goats?

a) 2% BW

b) 3% BW

c) 4% BW

d) 6% BW

9. Dry matter intake in Indian breeds of goats varies between RPSC 2019

(1) 10-25 g/w0.75 kg

(2) 20-40 g/w0.75 kg

(3) 35-80 g/w0.75 kg

(4) 100-140 g/w0.75 kg

10. How much more nutrients than the maintenance needs should be provided to breeding rams during breeding season ? RPSC 2019

(1) 30%

(2) 40%

(3) 50%

5. Use of NPN compounds in Livestock feeding

- **less expensive and readily available**

Non-protein Nitrogen Sources for Ruminants

- Urea (most widely used NPN compound in the ruminant diet)
- Ammonium acetate
- Ammonium bicarbonate
- Biuret
- Dicyandiamide
- Glutamine
- Glycine
- Oilseed meals

Urea as the Primary Source of NPN for ruminants:

- **most common**
- 100% degradability in rumen & contains 46.7% nitrogen
- **cheapest solid nitrogen source**.
- yielding up to 29.2 kg of protein per 100g of urea.

- only 1/3rd requirement of protein can be spared by urea
- Add NPN with high-energy feed such as grains/molasses
- Use NPN only when crude protein in the ration is below 13%
- 116 grams of urea for adult cattle and 10 g for sheep per day.
- Uniform mixing of urea is essential to avoid urea toxicity.

1. What is the primary nitrogen-containing compound used as a non-protein nitrogen (NPN) source for ruminants?
    - **a) Urea**
    - b) Ammonium bicarbonate
    - c) Biuret
    - d) Glycine
2. How much nitrogen does urea contain, making it an effective NPN compound in ruminant diets?
    - a) 20.5%
    - **b) 46.7%**
    - c) 32.5%
    - d) 12.8%
3. Which of the following should NOT be fed with NPN compounds like urea?
    - a) Cattle over 6 months
    - b) Dairy cows
    - **c) Preruminant calves and monogastric animals**
    - d) Ruminants consuming low-protein diet

1. How much urea should not be exceeded in adult cattle per day to prevent urea toxicity?
    - a) 50 grams
    - b) 90 grams
    - **c) 116 grams**
    - d) 150 grams
2. What is a symptom of urea toxicity in ruminants?
    - a) Lameness
    - b) Lack of appetite
    - **c) Bloat**
    - d) Excessive drinking
3. Which substance is commonly used to treat urea toxicity by lowering rumen pH?
    - a) Sodium bicarbonate
    - **b) Glacial acetic acid**
    - c) Magnesium sulfate
    - d) Calcium carbonate

1. How does the "Urea Molasses Mineral Block" (UMMB) method help in urea feeding?
    - a) Increases the energy content of the diet
    - **b) Provides a slow release of urea to prevent toxicity**
    - c) Prevents water loss in ruminants
    - d) Enhances protein digestibility of straw alone
2. What is the recommended proportion of urea in the Urea Molasses Mineral Block (UMMB)?
    - **a) 15%**
    - b) 5%
    - c) 25%
    - d) 10%
3. Which feed is essential for maximizing the utilization of urea in the rumen?
    - a) High-fiber feed
    - **b) High-energy feed like grains or molasses**
    - c) Low-energy roughage
    - d) Silage
4. What is the ideal nitrogen to sulfur ratio (N) to improve the utilization of urea in ruminant diets?

- a) 5:1
- b) 8:1
- **c) 10:1**
- d) 12:1

Unit 6

Feeding of Laboratory & wild animals and Metabolic Disorders

1. Feeding Practices for Swine
2. Feeding Practices for poultry
3. Feeding Practices for laboratory animals
4. Metabolic Disorder & symptom

1. Feeding Practices for swine

- VFA- 35-45% maintenance requirements (60% in ruminants)
- Crude Fibre- growing- 6-7% and 10-12% adult pig.
- Feed efficiency- 30-40% , Best feed efficiency
- ME = 0.96 DE
- 1st limiting AA- lysine
- Essential amino acid in pigs: 9
- Iron dextran injection (i/m) = on 4th and 14th day of age to prevent piglet anemia.
- FeSO- 42% of feed

Feeding of piglets:

1. Colostrum feeding
   - first milk and an essential source of energy, nutrients & immunity
   - It is important to maximize colostrum intake in the first six hours after birth (**150-280 ml/kg of birth BW**)
2. Milk replacer:
   - **extra nutrients** and energy
   - higher quality and easily digestible

Creep feed:

- **sucking piglets** for faster growth
- introduced at **7-14 days** of age and are fed till weaning.
- Piglets fed on creep ration attain **12-15 kg body weight at 8 weeks** of age.
- creep feed is generally mixed with **ferrous sulfate at the ratio of 9:1 to prevent anemia**.
- Composition of creep feed (BIS, 1986): **CP, min = 20%** and ME (kcal/kg), min = 3265

Grower ration:

- **18% CP** and 3170 kcal/kg ME value.

Finisher/breeder ration:

- contain **16% CP** and 3170 kcal/kg ME value.

Feeding of pregnant sow:

16% CP and 3000 kcal/kg ME value with 0.7% lysine.

Feeding of lactating sows:

2.0 kg of meal with 200g meal per piglet

1. Crude protein percentage of growing/ finishing ration is **JKPSC - 2019**

(A) 10-12
(B) 14-16
(C) 18-20
(D) None of the above

2. Which one of the amino acids is of greater practical importance in the diet of swine? RPSC 2019

(1) Leucine

(2) Lysine
(3) Cystine
(4) Methionine

3. A practical way to supplement iron and copper to the newborn piglets to prevent piglet anemia is RPSC 2019

(1) Giving injections of copper to newborn piglets.

(2) Giving injections of Vitamin E to newborn piglets.
(3) Painting the udder of sow with a thick solution of copper and iron sulphate.
(4) Allowing the newborn piglets to access soil

4. Pre starter broiler ration contain critical methionine: opsc 2018-19

(A) 3%

(B) 2%

(C) 1.2%

(D) None of the above

5. Where does fermentation primarily occur in pigs, which are hindgut fermenters?

a) Stomach

b) Caecum and Colon

c) Small intestine

d) Rumen

6. At what age should creep feed be introduced to piglets?

a) At birth

b) 7-14 days

c) 2 weeks

d) 8 weeks

7. What is the recommended crude protein (CP) content in a grower ration for pigs?

a) 16%

b) 18%

c) 20%

d) 14%

8. What injection should be given to piglets on the 4th and 14th day of age to prevent anemia?

a) Iron dextran injection

b) Vitamin D injection

c) Calcium supplement

d) Zinc sulfate injection

9. Which amino acid is the first limiting factor in pig growth and development?

a) Methionine

b) Arginine

c) Leucine

d) Lysine

10. What is the recommended weaning age for piglets in India?

a) 4 weeks

b) 6 weeks

c) 8 weeks

d) 10 weeks

2. Feeding Practices for poultry

Types of poultry feed
15 types of chicken feeds (BIS, 2007)

Bird type	Types of feed	Period
Broiler	Broiler pre – starter feed (BPSF)	**from 1 to 7 days.**
	Broiler starter feed (BSF)	**from 8 to 21 days.**
	Broiler finisher feed (BFF)	**from 22 to finish (42 days)**
Broiler breeder	Breeder chick for Broiler (BCFB)	from 0 to 4 weeks.
	Breeder grower Feed for Broiler (BGFB)	from 5 to 22 weeks
	Breeder layer feed for broiler (BLFB)	from 23 weeks onward.
	Breeder broiler feed for male (BBFM)	from 23 weeks onward.
Layers	Chick feed for layer (CFL)	from 0 to 8 weeks.
	Grower feed for layer (GFL)	from 9 to 20 weeks or until laying commences
	Layer Feed for Phase I (LFP-I)	from 21 weeks to 45 weeks
	Layer Feed for Phase II (LFP-II)	from 46 weeks to 72 weeks
Layer breeders	Chick feed for layer breeder (CFLB)	from 0 to 4 weeks
	Grower Feed for layer breeder (GFLB)	from 5 to 22 weeks
	Breeder layer feed (BLF)	from 23 weeks onward
	Breeder layer feed for male (BLFM)	from weeks 23 onward

Nutrients requirement in Broilers feeds as per BIS (2007)

Characteristic	Requirement for broiler feed		
	Pre-starter	Starter	Finisher
Moisture % by mass, Max.	11	11	11
CP % by mass, Min.	**23**	**22**	**20**
EE % by mass, Min.	3.0	3.5	4.0
CF % by mass, Max.	**5.0**	**5.0**	**5.0**
AIA % by mass, Max.	2.5	2.5	2.5
Salt (NaCl) % by mass, Max.	0.5	0.5	0.5
Ca % by mass, Min.	1.0	1.0	1.0
Total P % by mass, Min.	0.7	0.7	0.7
Available P % by mass, Min.	**0.45**	**0.45**	**0.45**
Lysine % by mass, Min.	1.3	1.2	1.0
Methionine % by mass, Min.	0.5	0.5	0.45
ME (kcal/kg), Min.	**3000**	**3100**	**3200**
Aflatoxin B_1 (ppb)	**20**	**20**	**20**

Nutrients requirement in Layer feeds as per BIS (2007)

Characteristic	Requirement for laying birds feed			
	Chick	Grower	Layer Phase I	Layer Phase II
Moisture % by mass, Max.	11	11	11	11
CP % by mass, Min.	**20**	**16**	**18**	**16**
EE % by mass, Min.	2.0	2.0	2.0	2.0
CF % by mass, Max.	7.0	9.0	9.0	10.0
AIA % by mass, Max.	4.0	4.0	4.0	4.5
Salt (NaCl) % by mass, Max.	0.5	0.5	0.5	0.5
Ca % by mass, Min.	**1.0**	**1.0**	**3.0**	**3.5**
Total P % by mass, Min.	0.65	0.65	0.65	0.65
Available P % by mass, Min.	0.40	0.40	0.40	0.40
Lysine % by mass, Min.	1.0	0.7	0.7	0.65
Methionine % by mass, Min.	0.40	0.35	0.35	0.30
ME (kcal/kg), Min.	**2800**	**2500**	**2600**	**2400**

Requirement of broiler breeder feeds as per BIS (2007)

Characteristic	Requirement for broiler breeder feed			
	Chick	Grower	Layer	Male
Moisture % by mass, Max.	11	11	11	11
CP % by mass, Min.	20	16	16	15
EE % by mass, Min.	2.5	2.5	2.5	2.5
CF % by mass, Max.	7.0	9.0	9.0	9.0
AIA % by mass, Max.	4.0	4.0	4.0	4.0
Salt (NaCl) % by mass, Max.	0.5	0.5	0.5	0.5
Ca % by mass, Min.	1.0	1.0	3.5	1.0
Total P % by mass, Min.	0.70	0.70	0.70	0.70
Available P % by mass, Min.	0.45	0.45	0.45	0.40
Lysine % by mass, Min.	1.0	0.8	0.85	0.80
Methionine % by mass, Min.	0.45	0.45	0.40	0.40
Metabolizable energy (kcal/kg), Min.	2800	2750	2800	2750

Requirement of layer breeder feeds as per BIS (2007)

Characteristic	Requirement for broiler breeder feed			
	Chick	Grower	Layer	Male
Moisture % by mass, Max.	11	11	11	11
CP % by mass, Min.	**20**	**16**	**17**	**16**
EE % by mass, Min.	2.0	2.0	2.0	2.0
CF % by mass, Max.	7.0	9.0	9.0	9.0
AIA % by mass, Max.	2.50	2.5	2.5	2.5
Salt (NaCl) % by mass, Max.	0.5	0.5	0.5	0.5
Ca % by mass, Min.	1.0	1.0	3.5	1.0
Total P % by mass, Min.	0.65	0.60	0.60	0.60
Available P % by mass, Min.	0.45	0.40	0.40	0.40
Lysine % by mass, Min.	0.95	0.70	0.70	0.80
Methionine % by mass, Min.	0.40	0.40	0.40	0.40
Metabolizable energy (kcal/kg), Min.	2800	2600	2600	2600

Nutrients requirements of poultry:

Energy requirement:

- Based on ME
- High-energy cereal grains are the principal energy sources.
- Fat at levels of 3-8% to increase dietary energy concentrations.

Protein requirement:

- Poultry requires the 11 essential AAs.
- Increase in Temp. = decrease in feed intake = increase in protein requirement
- Some AAs can be met by other AAs: Cystine = methionine, Tyrosine → phenylalanine, Glycine = Serine

1. Energy requirement (Kcal/Kg feed) in broiler finisher ration as per 815, 2007 is: PUNJAB 2016

a) 2800
b) 2900
c) 3100
d) 3200

2. Which of the following is not an essential amino acid for poultry: PUNJAB 2016

a) Arginine
b) Glycine
c) Valine
d) Glutamate

3. As per BIS (1992), CP and ME content of broiler starter feed should be **MPSC 2011**

(1) 20%, 2900 kcal/kg
(2) 23%, 2800 kcal/kg
(3) 20%, 2800 kcal/kg
(4) 23%, 2600 kcal/kg

4. Maximum level of inclusion of maize in poultry ration is RPSC 2019

(1) 50%

(2) 60%

(3) 70%

(4) 80%

5. What is the optimum Ca ratio for laying hens to support bone and shell formation?

a) 1:1

b) 1:1.2

c) 1:4

d) 1:2

6. What happens to poultry feed intake as environmental temperature increases?

a) It increases

b) It decreases

c) It remains constant

d) It fluctuates unpredictably

7. What is the recommended crude protein (CP) content in a pre-starter broiler feed?

a) 23%

b) 20%

c) 18%

d) 16%

8. Which vitamin deficiency can lead to slipped tendon disease in poultry?

a) Vitamin D

b) Vitamin A

c) Manganese

d) Vitamin C

9. What is the effect of light exposure on egg production in hens?

a) Decreases feed intake

b) Increases egg production

c) Decreases stimulation of the pituitary gland

d) Causes a decrease in body weight

10. At what age does egg production typically peak in laying hens?

a) 20-22 weeks

b) 28-30 weeks

c) 35-40 weeks

d) 60 weeks

Metabolic Diseases

1) Fatty liver
2) Ketosis
3) Acidosis (SARA)
4) Laminitis
5) Milk fever
6) Downer cow
7) Retained placenta
8) Bloat
9) Grass tetany
10) LDA
11) Udder edema

Fatty Liver

• Common metabolic disorder during transition period.

• Reason- Over conditioned animals during dry period (BCS>4.5)

• body fat is mobilized from adipose tissue into the bloodstream in the form of NEFA

• NEFA are taken by the liver, accumulate NEFA as triglycerides within the liver.

Preventatives for fatty liver

- Avoid excessive fattening
- **Glucogenic sub- glycerol, propylene glycol, monensin.**
- B-complex vitamins
- Vitamin E and selenium- as their antioxidant effects

Ketosis (Acetonemia)

- In dairy cows, ketosis is a lactation disorder usually associated with intense milk production and NEBAL (6-8 wk postpartum)
- An increase of "ketone bodies" in blood until they eventually begin to spill over into urine and (or) milk.
- Acetone, Acetoacetate, and β-Hydroxybutyrate
- Acetone: smell from breath

❑ Source of Ketones

1) From butyrate produced in the rumen and converted to beta-hydroxybutyrate by rumen mucosa during absorption
2) From metabolism in liver of LCFA primarily released from adipose tissue during energy deficit

1.Energy Deficit: Ketosis occurs during energy deficits (e.g., fasting, prolonged exercise, lactatic when glucose availability is low, prompting the body to utilize fat stores for energy.

2.Release of LCFAs: In energy deficits, hormone-sensitive lipase (HSL) in adipose tissue is activated, mobilizing stored triglycerides and releasing long-chain fatty acids (LCFAs) into the bloodstream.

3.Metabolism of LCFAs: Released LCFAs are transported to the liver and undergo β-oxidation ir mitochondria to produce acetyl-CoA. This acetyl-CoA can enter the tricarboxylic acid (TCA) cycle for energy or be diverted into ketogenesis.

4.Ketogenesis: When acetyl-CoA levels exceed the capacity of the Krebs cycle (due to low glucose), it is converted into ketone bodies (such as acetoacetate and β-hydroxybutyrate which are released into the bloodstream as alternative energy sources for tissues like the brain and muscles

- OAA is a key intermediate in the Krebs cycle and can be converted into aspartate through transamination reactions. Aspartate can subsequently be converted into glutamate, which is one of the most abundant neurotransmitters in the central nervous system.

Predisposing factors

- Glucose deficiency (NEBAL)- 60 to 85% of the available glucose drained as lactose in milk. Glucose demand exceeds gluconeogenesis in liver resulting in increased ketogenesis.
- Excessive fattening/ BCS- pre-partum
- Lactation demand- conducive to excess fat mobilization, which contributes to ketosis.
- Deficiency of ACTH- impaired gluconeogenesis
- Deficiency of OAA- Gluconeogenic
  - Inefficient utilization of mobilized FA- converted to ketones

Sign and symptoms

- Loss of appetite, refuse grain and eating only small amounts of roughage, acetone smell in breathe.
- A few affected cows will show nervous symptoms.
- Characterized by hypoglycemia- from a normal of 50 to 60 to as little as 25 mg/100 ml.
- Hyperketonemia- from a normal of less than 10 to as high as 50 mg/l00 ml blood
- Other frequently observed changes include increases in NEFA, decrease in liver glycogen and increases in liver lipid that can lead to liver damage.

Treatment

- Intravenous injection of glucose (50% dextrose)
- Intramuscular glucocorticoid (Isoflupredone)
- Gluconeogenic precursor- Sod. Propionate, glycerol, propylene glycol
- Supportive- vitamins

Ruminal Acidosis

high yielding cows with high grain ration.

Grain engorgement

Acidosis vs SARA

- Ruminal acidosis (pH<5.5)-
- SARA (pH<6)- excessive VFA production

Prevention

- Balancing the diet for starch and effective fibre.
- Avoid sudden changes of feed
- Roughages should be provided with grain/molasses.
- Buffers such as sodium bicarbonate also counteract acidosis

Milk fever/Parturient Paresis (hypocalcemia)

• An afebrile hypocalcemic disease in high producing animals when the demand of calcium for milk production exceeds the body's potential to mobilize calcium reserves.

Etiology:

• in older dairy cows (reduced ability to mobilize calcium from bone and in high milk producing breeds due to exhausted reserves)

• Lactation (usually first 72 hr postpartum)- Ca drain (10 mg/dl to 5 mg/dl)

• Parathyroid inactivity and dietary Ca supplementation during dry period

Clinical Signs

- Body temperature - subnormal (100-101oF)
- **Neck curved towards the flank**
- Occasionally, hyperexcitability

Prevention and treatment

- DCAD diet
- Restoration of Ca– half i/v and half s.c. in multiple sites - Retreat 8-12 hr later, if needed.
- Vit. D- 8 days before calving, s.c.

Downer cow syndrome/complex

- complication of periparturient hypocalcemia in cows that do not fully respond to calcium therapy and are unable to rise for >24 hr after initial recumbency.
- Develop a secondary recumbency from pressure damage to muscles and nerves.

Grass tetany/ Hypomagnesaemia

- Associated with early lactation grazing on lush green pastures
- Lush green pastures are deficient in Mg.
- Magnesium is essential for normal muscle function and nerve impulse transmission. A deficiency can lead to impaired muscle contractions and neuromuscular function.

- Tetanic or paretic type and subclinical types with depression of appetite and milk yield, slight nervousness, anemia.
- **Treatment-**
- Restoring normal Ca and Mg homeostasis and muscle relaxant
- 15-30 g of Mg supplement (MgO) per day

LDA

- Dislocation of abomasum to the left (LDA) or to right (RDA)
- Approx. 80-90% of incidences are LDA

  Most frequent in high producing cows in the first 4 weeks postpartum

- Low ruminal VFA absorption (papillae)- escape to abomasum, reduce abomasal motility, development of atony and onset of displaced abomasums.

Prevention-

- maintaining the forage to concentrate ratio
- Grain intake after calving should be increased slowly (0.25 kg/day)

1. In milk fever, body temperature of animal remains **Punjab 2023**

(a) Subnormal
(b) Elevated
(c) Highly elevated
(d) Normal

2. Ketosis occurs due to: **Punjab 2023**

(a) Positive energy balance in body
(b) Negative energy balance in body
(c) Positive protein balance in body
(d) None of the above

3. Eclampsia in dog is caused by deficiency of **Punjab 2023**

(a) Iron
(b) Phosphorus
(c) Calcium
(d) Copper

4. Basic biochemical defect in PPH **Punjab 2023**

(a) Hypocalcemia

(b) Hypoglycemia

(c) Hypophosphatemia

(d) None of the above

5. Following drug is specifically recommended in the treatment of post-parturient haemoglobinuria

Punjab 2023

(a) Calcium borogluconate

(b) 50% Dextrose

(c) Sodium acid phosphate

(d) 10% Magnesium sulphate

6. Lactic acidosis is caused by

(1) Accidental ingestion of large quantities of wheat grains

(2) Excessive intake of green fodder

(3) Excessive ingestion of dry fodder

(4) Excessive intake of Urea

7. Fatty liver disease is often associated with Punjab 2021

(A) Choline
(B) Niacin
(C) Thiamine
(D) Pyridoxine

8. Post parturient haemoglobinuria or Red Water Disease is basically caused due to acute deficiency of which mineral in the blood? **RPSC 2013**

(1) Copper
(2) Magnesium
(3) Phosphorus
(4) Calcium

9. Prepartum feeding of which of the following diets will significantly minimize the occurrence of parturient paresis in dairy cows? **MPPSC 2023**

[A] Negative DCAD diet
[B] High energy diet
[C] Positive DCAD diet
[D] Low roughage diet

10. Milk fever can be grouped as a disease of: **OPSC 2018-2019**

(A) Deficiency disease
(B) Infectious disease
(C) Metabolic disease
(D) Toxicological condition

Thank you