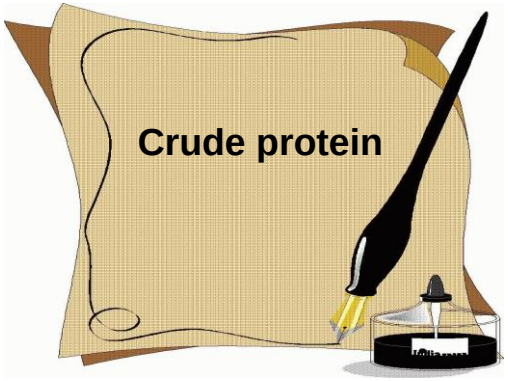

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Crude protein

- Nature — Organic nutrient — Nutrient contains carbon ,hydrogen ,and oxygen.
- Definition — Nitrogen containing substances — substance contains carbon ,hydrogen , oxygen and nitrogen.
- Other name — CP — Crude protein
- Feed fraction — Nitrogenous fraction of the feed — Most important feed fraction.
- Compartments — It contains two compartments — It contains true proteins and non protein nitrogen compartments.

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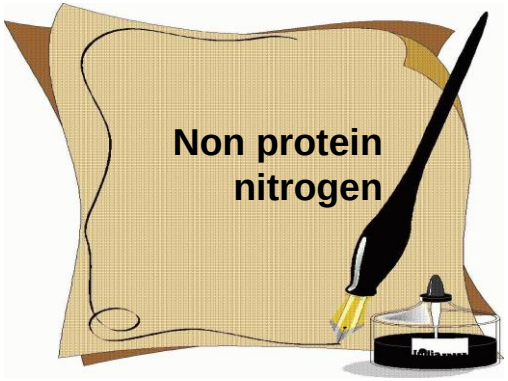

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Non protein nitrogen

- **Other name** — NPN
- **Definition** — Nitrogen containing substances without peptide bond.
- **Members** — Urea , ammonia , uric acid , biurea , nitrate , ect , …
- **Feed fraction** — Nitrogenous fraction of the feed — Most important feed fraction.
- **Feeding factors** — It needs species , permissible limits , graduation , and microbial requirements.

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Mechanism of NPN feeding

- **species** — Mature ruminants — For microbial actions.
- **Permissible limits** — The amount of non protein nitrogenous substances should not exceed than the permissible limits for different animals containing rumen (for ammonia 3 % of straw DM and for urea 1% of concentrate or 4 % (50 % water) for 100 kg straw).
- **Graduation** — ❑to adapt the bacteria in rumen to utilize urea. ❑to avoid the toxicity.
- **Microbial requirements** — They need : Source of energy , source of carbon skeletons , source of sulpher , source of phosphate and suitable ruminal pH.

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Microbial requirements

- **pH** — 6.0 – 6.9 — Optimum pH for action of microorganisms by acids from carbohydrates fermentation and alkaline characters of saliva.
- **Source of carbon skeleton** — It includes acids from carbohydrate fermentation and fatty acids.
- **Source of slupher** — It includes acids from carbohydrate fermentation and fatty acids.
- **Source of posphate** — It includes acids from carbohydrate fermentation and fatty acids.
- **Source of energy** — This means source of soluble carbohydrate which used for :Source of energy for micro flora which metabolized nitrogen , Source of carbon skeleton for microbial protein formation , control the ruminal pH for optimum activity for bacteria in rumen.

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Source of energy

- **Substrate used** — Nitrogen free extract in the form of starch or glucose.
- **Starch** — Best source because starch is slowly in fermentation and starch is not expensive. The amount of starch calculated
- **Glucose** — Bad source because glucose is rapid in fermentation and glucose is expensive.
- **Indirect source of energy** — Feed staffs containing starch as corn.
- **Functions**
  - ❑Source of energy for micro flora which metabolized nitrogen.
  - ❑Source of carbon skeleton for microbial protein formation.
  - ❑Control the ruminal pH for optimum activity for bacteria in rumen.

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Function of starch

Source of energy	*Source of carbon skeleton*	*Control ruminal pH*
For growth of microorganisms.	For amino acids and microbial protein synthesis.	For the optimum microbial activity.

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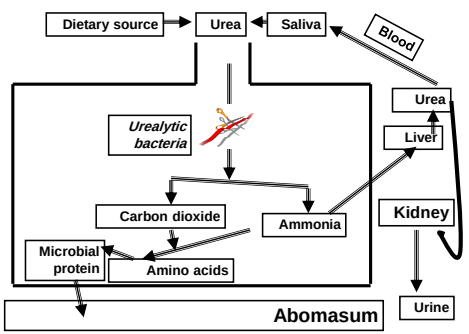
Urea Metabolism



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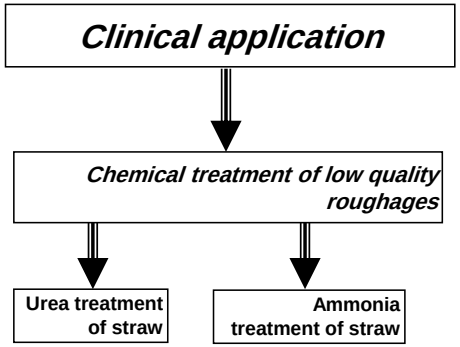

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Ammoniation of straw

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Bales were arranged in the stack according to a building like style.

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The stack was closely covered by fixing the margins by a cover of soil or sand.

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A stack of ammoniated rice straw during injection of ammonia.

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A stack of ammoniated rice straw after injection of ammonia

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Brown coloration of straw due to ammoniation.

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Ammoniation of straw

1. Improved of nitrogen content.
2. Improved of cellulose digestibility.
3. Preservative effect.
4. Improved of feed intake.
5. Economical importance by reducing the feed source.

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Preservative effect of ammonia

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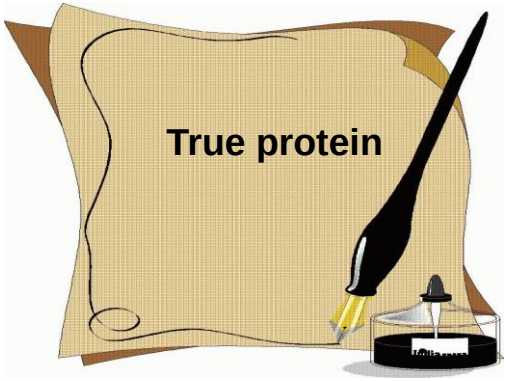
True protein

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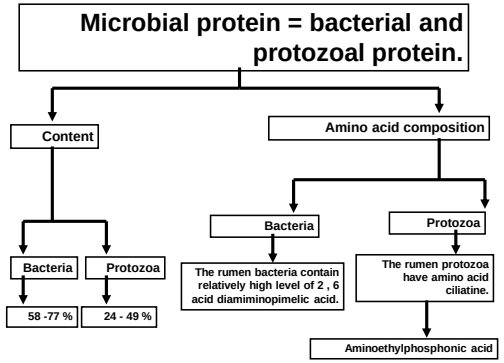
Microbial protein = bacterial and protozoal protein.
Content
Amino acid composition
Bacteria
Protozoa
58 -77 %
24 - 49 %
Bacteria
Protozoa
The rumen bacteria contain relatively high level of 2 , 6 acid diamiminopimelic acid.
The rumen protozoa have amino acid ciliatine.
Aminoethylphosphonic acid

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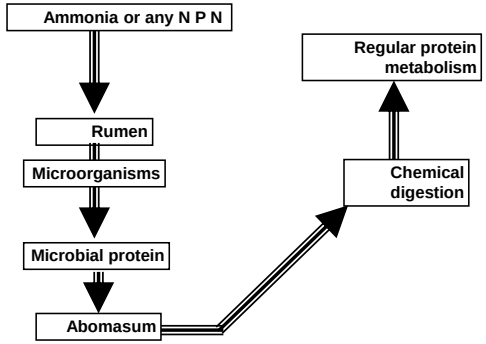
Ammonia or any N P N
Rumen
Microorganisms
Microbial protein
Abomasum
Chemical digestion
Regular protein metabolism

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True protein

- Chemical nature: Complex organic compounds.
- The monomer units: They are amino acids.
- Molecular weight: *500 – one million.*
- Classification: Simple proteins; Conjugated proteins.
- Nutritive value: It depends on % of essential amino acids.
- Made up: They One or more chains of amino acids which ٢ termed polypeptides.

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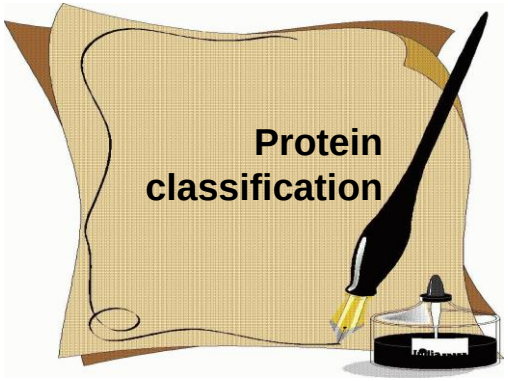

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Simple protein

- Biologically active protein.
- Oxygen-carrying proteins.
  - Albumins
  - Globulins
  - Glutelins
  - Prolamins
- Elongated peptide chains in composition.
- They are responsible for the mechanical proparties.
  - Collagen
  - Elastin
  - Keratin

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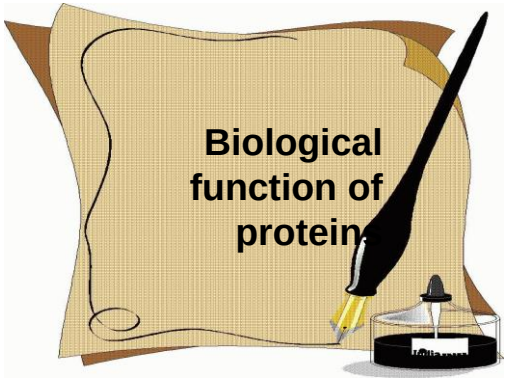

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Biological function of proteins.

Enzymatic protein	Physiological makeup and production function .
Structural protein	They are very important for support Example : collagen and keratin.
Storage protein	These proteins more amino acids example : ovalbumin – casein.
Defensive protein	These proteins protect against diseases . Antibodies combat bacteria and viruses.
Transport protein	These proteins are involved in transporting other substances for example :hemoglobin.
Hormonal protein	Hormonal proteins coordinate the body activities example :insulin.
Receptor protein	Receptor protein are built into the membrane of a nerve cell.
Contractile protein	These proteins are very important in movement example : actin and myosin . Contractile protein are responsible for the undulations of cilia and flagella, propel many cells.

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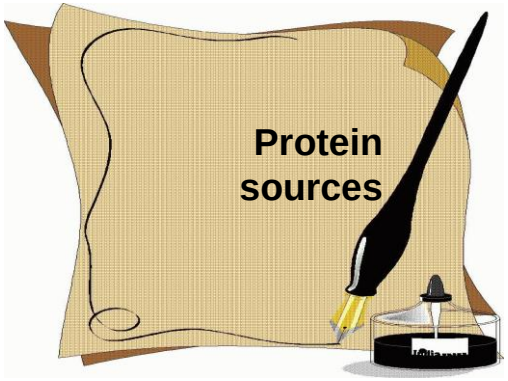

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Protein sources

1. Plant origin
2. Animal origin.
3. *Marine origin.*
4. Avian origin. — Conjugated proteins.
5. Microbial origin.

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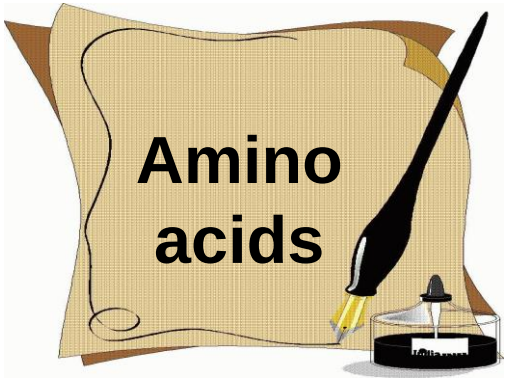

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Amino acids

- **Definition** — The monomer units of protein.
- **classification** — Essential amino acids and non essential amino acids.

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Essential amino acids

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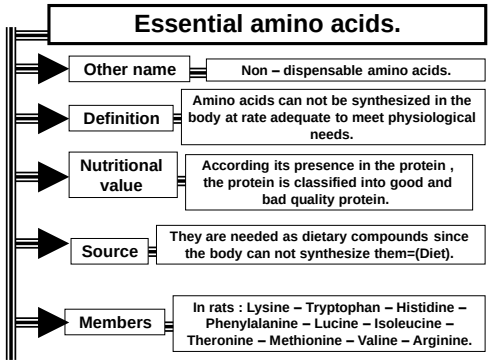
Essential amino acids.
Other name
Non – dispensable amino acids.
Definition
Amino acids can not be synthesized in the body at rate adequate to meet physiological needs.
Nutritional value
According its presence in the protein , the protein is classified into good and bad quality protein.
Source
They are needed as dietary compounds since the body can not synthesize them=(Diet).
Members
In rats : Lysine – Tryptophan – Histidine – Phenylalanine – Lucine – Isoleucine – Theronine – Methionine – Valine – Arginine.

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Non - essential amino acids

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Nonessential amino acids

- Other name: Dispensable amino acids.
- Definition: Amino acids can be synthesized in the body at rate adequate to meet physiological needs.
- Nutritional value: According its presence in the protein , the protein is classified into good and bad quality protein.
- Source: They are not need as dietary compounds since the body can synthesize them=(Body)
- Members: In rats : Glycine – Alanine – Serine – Tyrosine – Aspartic acide –Glutamic acid – Proline –Cystine– Hydroxy proline.

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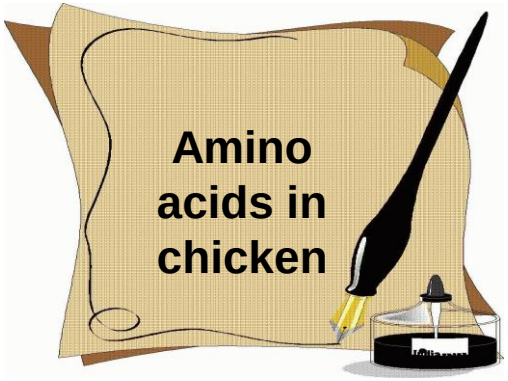

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Amino acids in chicken.

- Classification: Essential , semi essential and non essential.
- Essential amino acids: Lysine – Tryptophan – Histidine – Phenylalanine – Lucine – Isoleucine – Theronine – Methionine – Valine – Arginine.
- Semi essential amino acids: Glycine or Serine –Glutamic acid – Proline .
- Non essential amino acids: Alanine — Aspartic acide – Cystine– Hydroxy proline.

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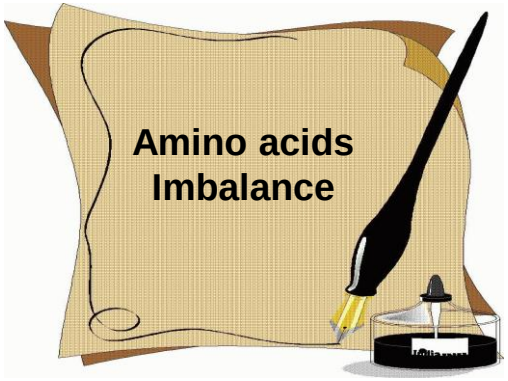
Role of glycine in growing chicks.



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Role of glycine in growing chicks.

Glycine

Glycine plays role in birds which uric acid as the end product of nitrogen metabolism since the formation of uric acid requires glycine, however, the ability to synthesize lysine in the growing chick can not meet the demand for maximum growth rate.

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Amino acids Imbalance

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Amino acids Imbalance.

An amino acid imbalance results from the addition to a low-protein diet of one or more amino acids, other than the growth limiting one, in amounts that are not individually toxic and yet cause depressions in food intake and growth that are readily prevented by a supplement of the growth limiting amino acid.

Rates prefer a protein-free diet to an imbalanced one and when corrected, leave the protein-free diet. The imbalanced diet also .interferes with protein synthesis in the liver.

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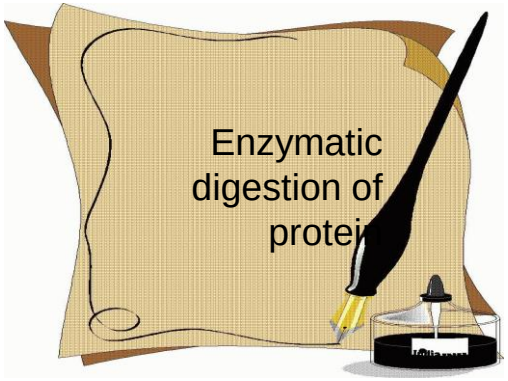

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Enzyme	Site of production	Splits peptide bonds adjacent to	pH of optimal activity
Pepsin	Mucosa of stomach	Tryptophan Phenylalanine Tryosine Methionine Leucine	1.8-2
Trypsin	Pancreas	Arginie Lysine	8-9
Chymotrypsin	Pancreas	Aromatic amino acids Methionine	8-9
Elastase	Pancreas	Aliphatic amino acids	8-9
Carboxy- Peptidase A	Pancreas	Aromatic amino acids	7.2
Carboxy Peptidase B	Pancreas	Arginine Lysine	8.0
Aminopeptidase	Mucosa of intestine	Amino acids with free NH_2 groups	7.4

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Effect of nutritional conditions on Activity of proteolytic enzymes

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Effect of nutritional conditions on Activity of proteolytic enzymes.

1. Effect of protein level in the diet.
2. Significance of protease inhibitors.
3. Over heating of protein.

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Effect of protein level in the diet.

1. Secretion of protealytic enzymes by the pancreas appears to be regulated by the presence of protein in intestinal lumen.
2. The dietary proteins probably act by binding the enzymes in the gut content. With increase of protein intake, the amount of free enzyme present in the intestinal lumen will drop, thus enhancing the synthesis and secretion of pancreatic enzymes.

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Significance of protease inhibitors.

1. Protease inhibitors present in soybeans and other leguminous seeds.
2. protease inhibitors are heat sensitive.
3. Unheated soybeans or of isolated soybeans trypsin inhibitors cause increased secretion of pancreatic enzymes and hypertrophy of the pancreas.
4. Growth depression caused by feeding the trypsin inhibitor may be attributed to :
   1. The loss of amino acids present in enzymes being secreted by a hyperactive pancreas and finally excreted in the feces.
   2. The resistance of native soybean protein to digestion by trypsin unless first denaturated by heat.

Over heating of protein

- Time of heating: By prolongation of heating time, at fixed temperature, protein digestibility tends to decrease.
- Temperature applied: High temperature tend to reduce protein digestibility.

Factors affecting protein digestibility.

Factors affecting protein digestibility :

1. The nature of protein.
2. Level of dietary proteins.
3. Fiber content.
4. Heat treatment.
5. Age and species of the animal.
6. Ration composition.

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Level of dietary protein.

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The apparent digestibility of crude protein is particularly dependent upon the proportion of protein in the food.

Why?

The reason for this is that the metabolic fecal nitrogen (MFN) represents a constant value. In ruminants a constant, the output of metabolic fecal nitrogen is equivalent to 3 gm of crude protein/100 gm of food DM eaten.

If the food contains 6% crude protein, the apparent digestibility of this protein = $\frac{6 - 3}{6} \quad X = \frac{3}{6} \quad X\ 100 = 50\%$

If the food contains 12% cp, the effect of the MFN is relatively smaller and the maximum possible apparent digestibility of the food protein rises to 75%.

$\frac{12 - 3}{12} \quad X = \frac{9}{12} \quad X = \frac{3}{4} \quad X\ 100 = 75\%$

Foods containing less than 3 gm proteins % such as cereal straws, may have negative digestibility coefficients for protein. .

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The nature of protein.

1. There are differences in digestibility between plant and animal proteins as well as between proteins of different plant or animal species.
2. The protein (Keratin) of hair, feathers, hoof, horn, is relatively indigestible.

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Fiber content.

1. Among the plant feeds, wide variations in fiber content and protein digestibility are found within each group of foodstuffs.

   The crude fiber fraction of food has a greatest influence on its digestibility and both the amount and chemical composition of the crude fiber are important.
2. An increase in the proportion of crude fiber in a particular feed is generally accompanied by greater signification of cell walls.
3. An increase in the crude fiber content of feeds causes a reduction in the digestibility of protein (total organic matter: cell contents).

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Heat treatment.

There are at least three factors which determine the effect of heat on the digestibility of food proteins. Type of heat , Time of heating and Temperature applied.

- Type of heat: Moist or dry. Usually, moist heat treatment of protein is less destructive than dry heat.
- Time of heating: By prolongation of heating time, at fixed temperature, protein digestibility tends to decrease.
- Temperature applied: High temperature tend to reduce protein digestibility.

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Age and species of the animal.

1. Digestibility of protein differs according to the age of the animal.
2. Young animals shows lower digestibility than adult animal of the same species.
3. The differences in digestibility of protein among different animal species depend upon the fiber content of the ration.
4. Food low in fiber is equally well digested by ruminants and non ruminants.
5. More fibrous food is better digested by ruminants. Generally ruminant animals digested protein some what more efficient that single-stomached animals.

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Ration composition .

Energy rich rations stimulate microbial growth and multiplication in the rumen, thus increase protein utilization by microflora and digestion.

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