Lecture 4

PROTEINS

Protein is important in feeding farm animals and human beings, because it is the nutrient found in highest concentration (after water) in organic and muscle tissues.

The young, growing animal has the highest requirements for protein when expressed as a percentage of the diet. In addition, productive functions such as gestation and lactation greatly increase the protein requirement because of the needs of the foetus during gestation and for milk protein production during lactation.

Protein is one of the critical nutrient particularly for young rapidly growing animals and for high producing mature animals such as dairy cows and fish. Optimal use of protein is a must in any practical feeding system, since protein supplements are much more expensive than energy, fibrous and fat feedstuffs and wasteful usage increase the cost of production in almost all instances.

If we are short of fat in our diet, then carbohydrates and proteins can be converted into body fat. If we are short of carbohydrate in the diets, fats and proteins can be converted into energy, but if we are short of protein in the diet, carbohydrates and fats cannot be used to build up our bodies or repair the wear and tear that takes place.

It is therefore essential that an adequate quantity and quality of protein is supplied by our feed/food.

Protein quality is a measure of the ability of protein supplement/feedstuffs to supply needed amino acids in the diet when ingested (plant and animal origins).

For practical purposes, protein quality refers to the amount and ratio of essential amino acids in a protein source.

The amino acids contained may either be essential amino acids, which are those amino acids that are required for the functioning of the body but cannot be synthesized in the body, hence, they have to be supplied in the diet (indispensable).

The non-essential amino acids are those amino acids that are necessary for the functioning of the body but can be synthesized within the body (dispensable). Therefore, a good quality protein is that which contains a high proportion of the essential amino acids.

The term biological value is used to express protein quality and it is dependent on the relative quantities of the essential amino acids present. For all practical purposes, egg has a biological value of 100 and considered a standard good quality protein, however, cereals like maize/corn have low biological value of 40 as it lacks the amino acid lysine.

A total of 23 primary amino acids are required by the body. Ten (10) amino acids essentials are Histidie, Arginine, Lysine, Leucine, Phenylelaine, Valine, Tryptophan, Threonine, Isoleucine, Methionine. The 12 non-essential amino acids are – Glu, Gln, Asp, Asn, Pro, Hyp, Cystine, Cysteine, Tyr, Ely, Ala, Ser.

Proteins are complex polymer of amino acids, found in all cells, involved in most of the vital chemical reactions of plant and animals metabolism. It is the specific sequence of amino acids and the manner in which the amino acids strands are connected to each other than determines the physical and chemical properties of each individual protein and its biological functions.

For ruminant animals, the need for a nitrogen source which can be partially degraded in the rumen to ammonia and most likely for some of the essential amino acids such as methionine or for some peptides.

However, high producing ruminant animals also by-pass some ingested proteins into the intestine without it being broken down in the rumen. Hence, it is probable that protein quality is more important under these circumstances than for animal producing at low levels and consuming much less feed.

TYPES OF PROTEIN BASED ON ORIGIN

There are two main types of proteins –

(i) Proteins from animal origin

(ii) Proteins from plant origin

(1) Proteins from animal origin

These are proteins of animal origin characterized by a better quality protein than vegetable proteins. They have high biological value meaning high profile of essential amino acids. They are called “complete” protein. They are costly (high price), not affected by seasonal variations, available all year round. Lack of or limited antinutritional factors. Require little or no processing before incorporation in human or animal feed/food. Included in small quantities in

animal feeds. Chemical composition is relatively standardized. Crude protein greater than 65% CP. Examples include fish meal, meat meal, blood meal, egg, milk or dairy products, feather meal, chicken offal meal, maggot meal, termite meal, grasshopper meal, frog/toad meal.

(2) Plant Proteins (PP)

These are proteins of plant origin, often termed "incomplete" proteins. Characterized by low biological value (BV) compared to animal proteins meaning lower profile of essential amino acids. PP is included in higher percentages in animal feed, percentage constituent crude protein of PP is between 20-45% CP. Its use is affected by seasonal availability. Not available all year round. It contains antinutritional factors especially in the raw state, proximate composition or chemical composition is not standardized i.e. variable. However the price of PP compared to animal proteins is very low. PP requires a lot of processing before incorporation in animal feed. Deficient in one or more essential amino acids and the quality is lower compared to animal proteins.

Examples include – soybean meal, groundnut cake, cottonseed cake, sunflower cake, palm kernel cake, rapeseed meal, jack bean, pigeon pea meal, castor seed meal.

FUNCTIONS OF PROTEINS

Proteins are highly complex nitrogenous organic compounds occurring naturally in al living matter and forming an essential part of animal feed requirements.

They are very important for many cellular functions as follows:

- Proteins are the chief structural units of protoplasm
- Proteins in diets serve as primary source of amino acids the building block of cellular proteins
- The biological catalysts known as enzymes are proteins
- Some of the hormones, the regulators of chemical reactions are proteins or peptides
- Antibodies are complex proteins
- Protein play an important role in the transport of water, inorganic ions, organic compounds and oxygen
- They can contribute through functional properties of proteins, in foods by contributing to colour, flavor, odour, foam formation e.g. maillard and browing reactions.