

1) **What do you understand by the term “biological value of proteins”?**

This is a direct measure of the proportion of the food protein which can be utilized by an animal for synthesizing body tissues and compounds, and may be defined as proportion absorbed nitrogen which is retained by the body.

A biological trial is conducted in which nitrogen intake and urinary and faecal excretions of nitrogen are measured along with endogenous fractions in these two materials

Calculation

$$BV = \frac{NI - (FN - MFN) - (UN - EUN)}{NI - (FN - MFN)} \times 100$$

$$NI - (FN - MFN)$$

NI-nitrogen intake

FN-faecal nitrogen lost on a test diet

UN- urinary nitrogen on test diet

MFN = Metabolic faecal nitrogen consists of spent digestive enzyme, abraded mucosa and bacterial N)

EUN= Endogenous urinary nitrogen

- Endogenous urinary nitrogen results from irreversible reactions involved in the breakdown and replacement of various protein secretions and structure in the body
- Thus both the faecal and urinary endogenous fractions represent nitrogen which has been absorbed and utilized by the animal rather than nitrogen which cannot be so utilized

2) **List and explain the various methods of assessment of protein quality**

i. Protein efficiency ratio (PER)

It is the simplest method. It measures the weight gain of a growing animal in reference to its protein intake

Major sources of error in this method is the use of weight gain per se as sole criterion of protein value. It also does not include protein required for maintenance

$$PER = \frac{\text{Gain in body mass (g)}}{\text{Protein intake (g)}}$$

ii. Net Protein Ratio (NPR)

It was developed to overcome the drawbacks of PER method. In this method another group of animals beside test animals included to whom protein free diet is given and the amount of protein required for maintenance was calculated.

It is calculated as difference in final body weight between test group fed the protein in diet, and a group receiving a protein free diet divided by the amount of protein taken by the test group.

iii. **Biological Value (BV) of proteins**

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A biological trial is conducted in which nitrogen intake and urinary and faecal excretions of nitrogen are measured along with endogenous fractions in these two materials

Calculation

$$BV = \frac{NI - (FN - MFN) - (UN - EUN)}{NI} \times 100$$

$$NI - (FN - MFN)$$

NI- nitrogen intake

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iv. **Digestibility Coefficient**

It is the proportion of food protein which is absorbed. It is computed from the measurement of the nitrogen content of the food ingested and the nitrogen excreted in faeces, taking into account the extent to which faecal nitrogen is endogenous which in turn is measured as faecal nitrogen lost on a protein-free diet

$$\text{True protein digestible} = \frac{I - (F - Fe)}{I} \times 100$$

Where I= Nitrogen intake

F= Faecal nitrogen lost on a test diet

Fe= Faecal nitrogen lost on a protein free diet

v. **Amino Acid Score**

It is a measure of the concentration of each essential amino acid in the test protein expressed as a percentage of that amino acid in the reference protein such as egg or milk or a provisional amino acid pattern. The AAS do not take the digestibility of the protein or absorption of amino acid into account, and thus, actual utilization from a given food might differ

$$AAS = \frac{\text{mg of amino acid in 1 gram of test protein}}{\text{mg of amino acid in 1 gram of reference protein}} \times 100$$

vi. Net Protein utilization (NPU)

It is the proportion of food nitrogen that is retained in the body under standard conditions. It is the product of digestibility coefficient and biological value divided by 100. The NPU gives a more complete expression of protein quality than AAS.

When food proteins are completely digested, the NPU and biological value would be the same.

vii. Net dietary calories percent NDP (PE ratio)

It relates protein quality to energy intake. Dietary protein is expressed as percentage of total calories rather than as that of total weight and is calculated as

$$\text{NDP Cal\%} = \frac{\text{Protein calories}}{\text{Total Calorie intake}} \times 100 \times \text{NPU}$$

viii. Protein digestibility corrected amino acid score (PDCAAS)

It is the amino acid score corrected for the digestibility of the protein. It is a method of evaluating the protein quality based on both the amino acid requirements of humans and their ability to digest it.

PDCAAS = (mg of limiting amino acid in 1g of test protein / mg of same amino acid in 1g of reference protein) x faecal true digestibility percentage