BIHAR ANIMAL SCIENCES UNIVERSITY
Bihar Veterinary College, Patna
Department of Animal Nutrition

UG Lecture (UNIT-I)

Methods of Feed Protein Evaluation in Livestock
(Part-1)

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EVALUATION OF PROTEIN QUALITY IN MONOGASTRIC ANIMALS

➤ **Protein is mainly required for maintenance & building of body tissue.**

➤ **EAA come from diet.**

➤ **Depend on digestible protein quantity of feed but digestible protein figures are not exclusively measures of the value of a protein to livestock.**

➤ **Because the efficiency of absorbed protein differs from sources of protein.**

➤ **So, in order to allow such differences, different methods for evaluating proteins, such as;**

✓ **Protein efficiency ratio (PER)**

✓ **Net protein retention (NPR)**

✓ **Gross protein value (GPV)**

PER = gain in body weight (g) / protein consumed (g)

NPR = weight gain of TPG – weight loss of NPG / weight of protein consumed

Where; TPG = group given the test protein and

NPG = group of protein-free diet.

Gross protein value (GPV)

GPV = A/A°

Where;   A = g increased weight gain/g test protein &

A° = g increased weight gain/g casein.

✓ Live weight gains of birds receiving a basal diet containing 80 g CP/kg are compared with those of birds receiving the basal diet plus 30 g/kg of a test protein, and of yet others receiving the basal diet plus 30 g/kg of casein.

✓ Extra live weight gain per unit of supplementary test protein stated as a proportion of the extra live weight gain per unit of supplementary casein is the GPV of the test protein.

Nitrogen balance

➢ **Live weight gain may not be related to protein stored & more accurate evaluation of a protein may be obtained by using the results of N- balance experiments.**

➢ **Nitrogen consumed in the food is measured, together with that voided in faeces, urine & any other N-containing products such as milk, wool & eggs.**

➢ **When the N- intake is equal to the output, the animal is said to be in nitrogen equilibrium.**

Factors affecting Balance trials

✓ **Inadequate adaptation of trial animals to the diet & environment**

✓ **Collection & weighing of faeces & and urine**

✓ **Storage of faeces & urine**

✓ **Sampling of faeces & urine for chemical analysis.**

Biological value (BV)

✓ **Direct measure of proportion of food protein that can be utilized by animal for synthesizing body tissues & may be defined as proportion of absorbed nitrogen i.e. retained by the body.**

✓ **Balance trial is conducted in which N-intake & urinary & faecal excretions of N are measured, along with endogenous fractions in these two attribute.**

BV = N intake − (faecal N − MFN) − (urinary N − EUN) /

N intake − (faecal N − MFN)

Where;

MFN = metabolic (endogenous) faecal nitrogen &

EUN = endogenous urinary nitrogen.

Calculation of biological value for maintenance and growth of the rat

Food consumed daily (g)	6.0
Nitrogen in food (g/kg)	10.43
Daily nitrogen intake (mg)	62.6
Total nitrogen excreted daily in urine (mg)	32.8
Endogenous nitrogen excreted daily in urine (mg)	22.0
Total nitrogen excreted daily in faeces (mg)	20.9
Metabolic faecal nitrogen excreted daily (mg)	10.7

$$BV = \frac{62.6 - (20.9 - 10.7) - (32.8 - 22.0)}{62.6 - (20.9 - 10.7)}$$

$$= 0.79$$

✓ **BV of a food protein also depends upon the number & kinds of AA present in the diet.**

✓ **Closer the AA composition of food protein approaches that of the body protein, the higher will be its biological value.**

✓ **Product of BV & digestibility is termed the Net Protein Utilisation (NPU) & is the proportion of N-intake retained by the animal.**

Biological values of the protein in various foods for maintenance and growth for the growing pig

Food	BV
Milk	0.95–0.97
Fish meal	0.74–0.89
Soya bean meal	0.63–0.76
Cotton seed meal	0.63
Linseed meal	0.61
Maize	0.49–0.61
Barley	0.57–0.71
Peas	0.62–0.65

Chemical score

➢ **Considered that the quality of a protein is decided by the AA** i.e. in greatest deficit when compared with a standard.

➢ Standard generally used been **egg protein**, but many workers now use a defined **AA mixture**.

➢ Content of each of the EAAs of a protein is expressed as a proportion of that in the standard (standard pattern ratio) & the lowest proportion taken as the score.

Calculation of chemical score

✓ **In wheat protein,** ex- EAAs in greatest deficit is lysine.

✓ Contents of lysine in egg & wheat proteins are 72 g/kg & 27 g/kg, respectively, & the chemical score for wheat protein is therefore, 27/72 = 0.37.

✓ **They are useful for grouping proteins but suffer a serious disadvantage in that** no account is taken of the deficiencies of AA other than that in greatest deficit.

Essential amino acid index (EAAI)

❖ **Geometric mean of the egg, or standard pattern, ratios of EAAs.**

❖ **Has advantage of predicting the effect of supplementation in combinations of proteins.**

❖ **Has the disadvantage that proteins of very different AA composition may have the same or a very similar index.**

❖ **Chemical score & EAAI are based upon gross AA composition.**

Discussions…………………………..

Questions, if any………………??

THANKS