Protein Quality

- Essential amino acid: an amino acid that the body cannot synthesize in amounts sufficient to meet physiological need.
- Non essential amino acid: an amino acid that can be synthesized in the body.

Protein Quality

- Complete protein: a protein containing all the essential amino acids in human nutrition in amounts of adequate for human use.
- High-quality protein: an easily digestible complete protein that amino acids fit the protein needed by human body.

Protein Quality

- Limiting amino acid: the essential amino acid found in the shortest supply relative to the amounts needed for protein synthesis in the body.
- Digestibility: the measure of the amount of amino acids absorbed from protein intake.

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Protein Digestibility

Food source	Protein digestibility (%)
Egg	97
Milk and cheese	97
Mixed US diet	96
Peanut butter	95
Meat and fish	94
Whole wheat	86
Oatmeal	86
Soybeans	78
Rice	76

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Protein Quality

- Reference protein: egg protein is used as a standard against which to measure the quality of other proteins.

Protein Quality

- Reference protein: egg protein is used as a standard against which to measure the quality of other proteins.
- Nitrogen balance: the amount of nitrogen consumed (N-in) as compared to the amount of nitrogen excreted (N-out).

Protein Quality

- The average amino acid weight is about 6.25 times as much as the nitrogen it contains, so the scientists can estimate the amount of protein in a sample of food, body tissue, or excrete by multiplying the weight of nitrogen in by 6.25.

Nitrogen Balance

- Nitrogen equilibrium/zero nitrogen balance: N-in = N-out
- Positive nitrogen balance: N-in > N-out
- Negative nitrogen balance: N-in < N-out

Measures of Protein Quality

- Chemical score: a rating of the quality of a test protein arrived at by comparing its amino acid pattern with that of a reference protein.

Reference Pattern for Chemical Score of Protein

Essential amino acids	Whole egg mg AA per g N
Histidine	148
Isoleucine	340
Leucine	540
Lysine	440
Methionine	355
Phenylalanine	580
Threonine	294
Tryptophan	106
Valine	410
Total	3,210

Measures of Protein Quality

- Biological value (BV): the amount of protein nitrogen that retained from a given amount of protein that has been digested and absorbed.
- BV = [Food N – (Fecal N – Metabolic N) – (Urinary N – Endogenous N)] / [Food N – (Fecal N – Metabolic N)] x 100
- BV = N retained / N absorbed x 100

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Biological Value of Proteins

Protein	Biological Value
Egg	100
Milk	93
Rice	86
Beef, fish	75
Corn	72
Peanut flour	56
Wheat gluten	44

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Measures of Protein Quality

- Net protein utilization (NPU): the amount of protein nitrogen that is retained from a given amount of protein nitrogen eaten.
- NPU = [Food N – (Fecal N – Metabolic N) – (Urinary N – Endogenous N)] / Food N x 100
- NPU = N retained / N intake x 100

Measures of Protein Quality

- Protein efficiency ratio (PER): the weight gained from protein intake.
- PER = Weight gain (g) / Protein intake (g)

Protein-kCalorie Malnutrition

- Kwashiorkor: a malnutrition caused by protein deficiency in the presence of adequate kcalories.
- Marasmus: a malnutrition caused by inadequate kcalories.

Recommended Protein Intakes

- RDA = 0.8 g/kg body weight.
- Factors are considered in establishing recommended protein intake:
  - Body weight
  - Lean body

Protein Sources

- Animal foods
- Cereals
- Vegetables