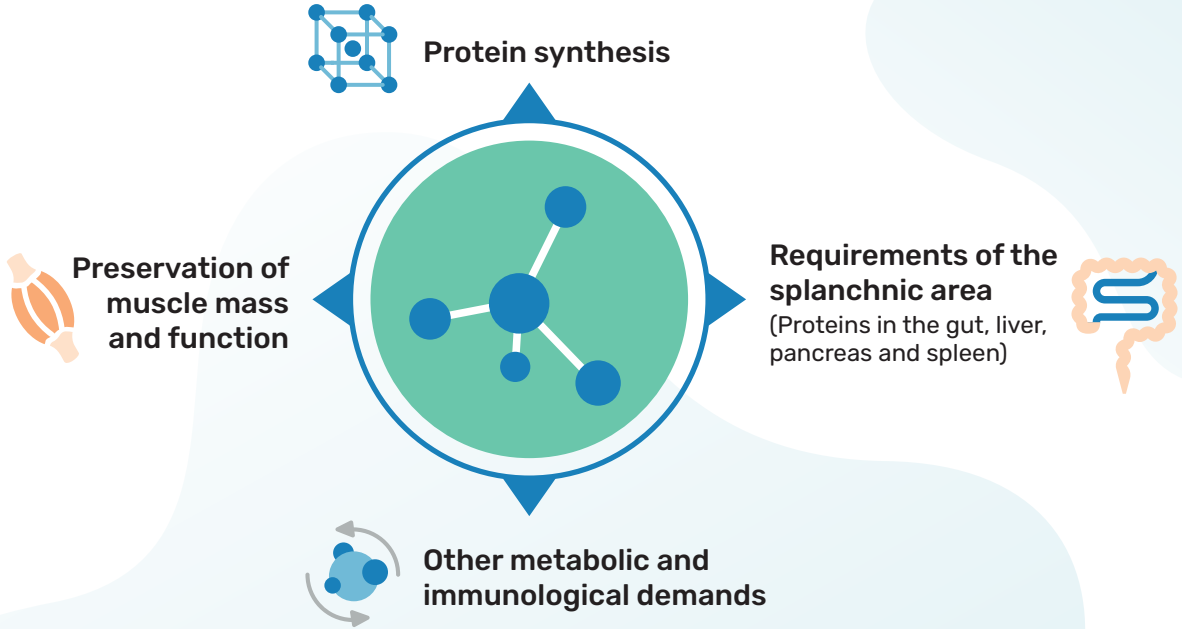
Danone Nutricia Campus

Nutrition Essentials: Protein Quality in Medical Nutrition

Plant and dairy proteins can meet patient needs

Proteins are vital for a healthy life[1–4]

Proteins are essential for maintaining biological functions in the body.[1–4]

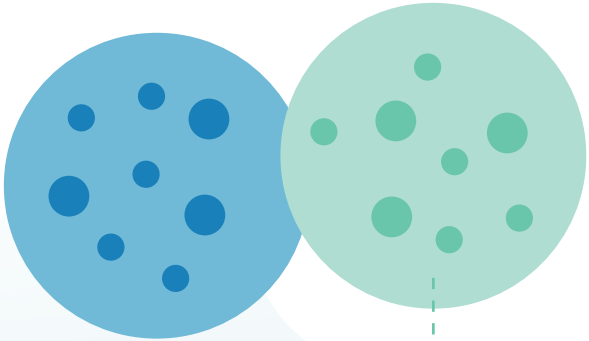


Amino acids are the building blocks of proteins[1]

Proteins are made of amino acids, which can be classified into essential and non-essential.*[5,6]

Essential amino acids

Cannot be synthesized by the body and must be supplied by the diet.



Non-essential amino acids

Can be synthesized from other essential amino acids in healthy individuals.

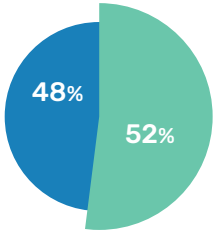
Conditionally essential amino acids

In disease, non-essential amino acids can become conditionally essential when the body cannot synthesize sufficient amounts to meet metabolic needs. Therefore,non-essential amino acids play an important role for patients.

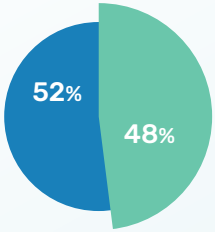
*For the remainder of this resource, the terms "essential," "non-essential" and "conditionally essential" will be used to describe dietary amino acids, while recognizing that all amino acids play essential roles in the body.

Different protein sources contain varying amounts of essential and non-essential amino acids[7]

Dairy proteins (such as casein and whey) are richer in essential amino acids.[7]

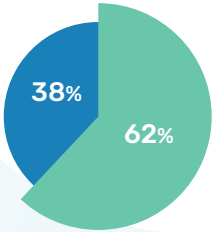


Casein

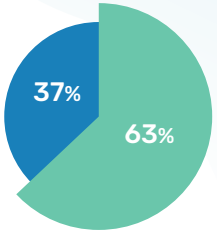


Whey

Plant proteins (such as soy and pea) are richer in some non-essential amino acids.[7]



Soy

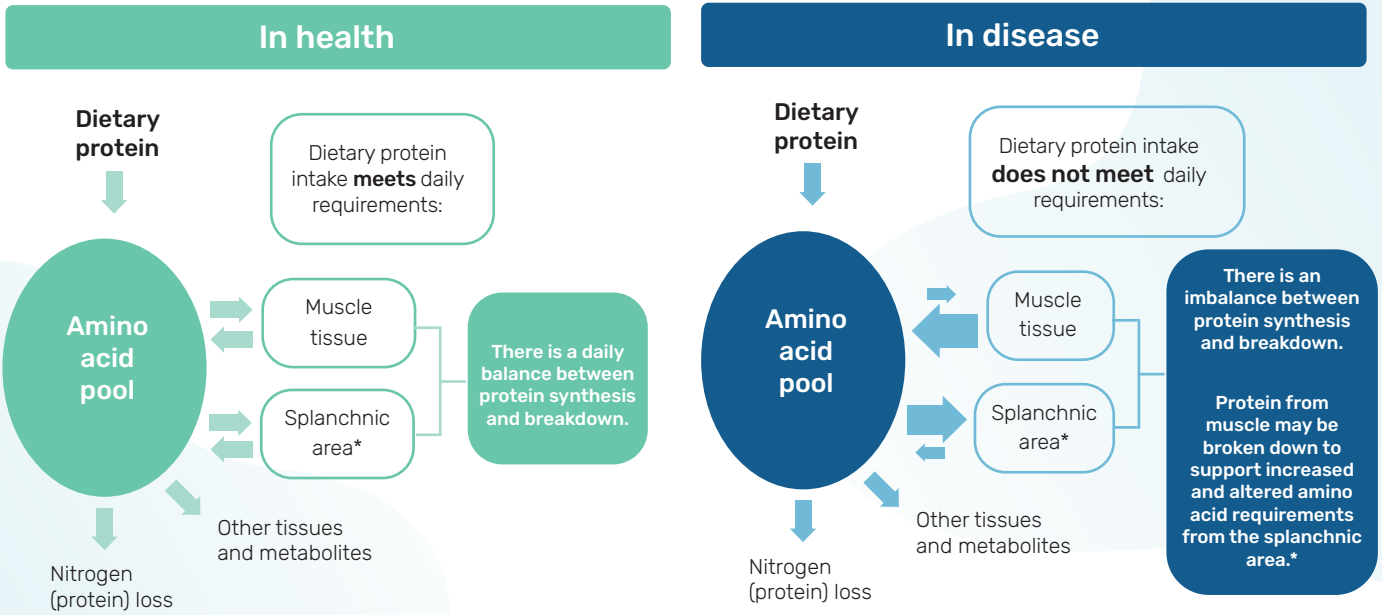


Pea

Essential Non-essential

Dairy, certain individual plant sources, and blends of different protein sources can meet daily requirements for essential amino acids[7]

Amino acid metabolism differs depending on health conditions of patients, resulting in different amino acid requirements[8,9]



*Gut, liver, pancreas, spleen.

Guidelines for protein intake in different populations have been established[10–13]

Protein intake recommended for healthy adults is **0.8 g/kg/day**[10]

However, some patient groups have **higher protein requirements:**

Older adults with or at risk of malnutrition: **1.2–1.5 g/kg/day**.[11,12]

Patients with cancer: **1.0–1.5 g/kg/day**.[13]

Patients with severe injury or illness: **2.0 g/kg/day**.[11,12]

Non-essential amino acids can become conditionally essential[4,14–19]

In some patient groups, the ability to synthesize non-essential amino acids in sufficient amounts is compromised.[4,14–19]

These can include patients with cancer, critical illness, gastrointestinal disorders, metabolic disorders and compromised immune systems, as well as those who have undergone surgery or trauma.[4,14–19]

For these patients, non-essential amino acids become "conditionally essential."[4,14–19]

Conditionally essential amino acids
Cysteine
Arginine
Glycine
Glutamine
Proline
Tyrosine

Plant proteins are high in **arginine & glycine**, two conditionally essential amino acids that are lower in dairy proteins.

Guidelines for essential amino acids[6]

The FAO Expert Consultation report published in 2013 set recommendations for essential amino acid intake in healthy adults.[6]

Recommended amino acid scoring patterns for older children,* adolescents and adults.

Histidine	Isoleucine	Leucine	Lysine	Sulphur amino acids	Aromatic amino acids	Threonine	Tryptophan	Valine
Scoring pattern mg/g protein requirement								
16	30	61	48	23	41	25	7	40

Currently, there are no recommendations for patient groups with higher protein needs. Until such guidance is established, patients should, at minimum, receive the essential amino acid intake recommended for healthy adults.

*>3 years.

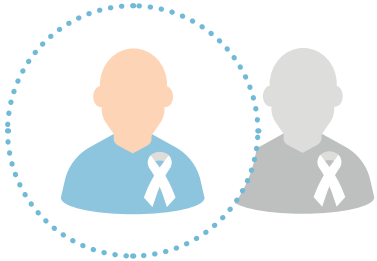
FAO, Food and Agriculture Organization.

Sulphur amino acids: Methionine & Cysteine
Aromatic amino acids: Phenylalanine & Tyrosine

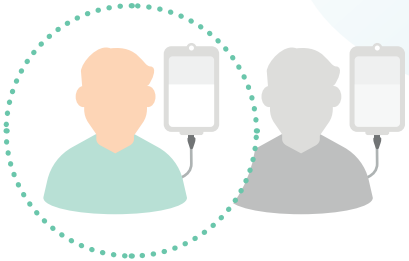
Guidelines for non-essential amino acids

- There are **no existing recommendations** for non-essential amino acid requirements.
- However, there is **increasing recognition** of the importance of **non-essential amino acids** and recommendations have been proposed in literature.[20–22]
- Similar to recommendations for essential amino acids, the proposed recommendations for non-essential amino acids are also **only for healthy adults.**

Many patients fail to meet their protein requirements[23,24]



~1 in 2 patients with cancer fail to meet their recommended protein intake.[23]



~1 in 2 malnourished hospitalized patients have inadequate protein intake on the fourth day in hospital.[24]

The consequences for these patients can be severe

Inadequate protein intake may lead to malnutrition, which can result in decreased functional status and quality of life; and increased morbidity, mortality and healthcare costs[25–29]

Oral nutritional supplements (ONS) and tube feeds can help patients meet their increased protein requirements

Protein isolates used in ONS and tube feeds are more concentrated than the protein found in whole foods. ONS and tube feeds contain dairy and/or plant protein isolates.

Whole foods

Amount required to reach 30 g of protein:

915 ml milk

600 g cooked peas

140 g cooked soy beans

Tube & ONS products

Approximately 200-500 ml of a medical nutrition product, depending on the protein density.

Protein quality and quantity in ONS

- In conditions where protein intake is inadequate, ensuring high protein quality becomes even more important.
- The ultimate goal of providing high protein quality and adequate quantity is to meet critical metabolic demands, such as building body protein, growth, tissue repair and supporting body functions, which can fluctuate during the disease process[6].
- Protein quality is defined as the capacity of a protein source to meet amino acids requirements to satisfy human metabolic needs.[5,6]

ONS, oral nutritional supplements.

How is protein quality measured?

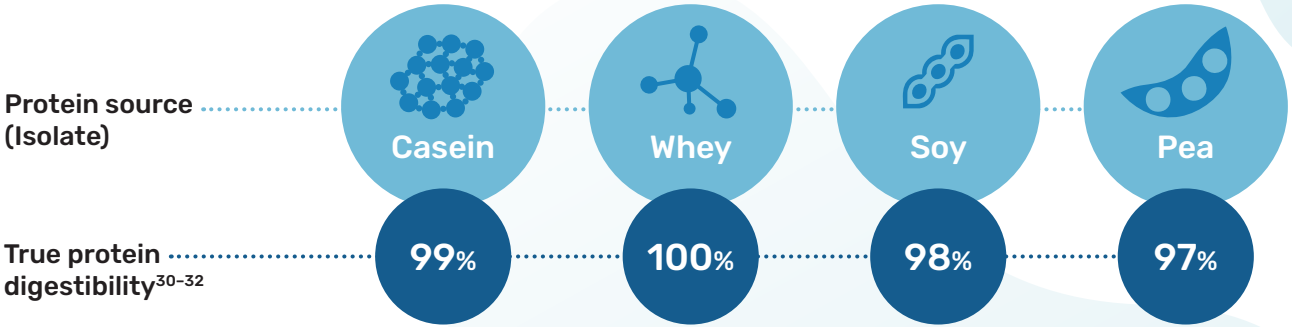
One of the most prevalent and well known methods to measure protein quality is the Protein Digestibility-Corrected Amino Acid Score (PDCAAS), which has been recommended by the FAO/WHO/UNU.[5,6] The PDCAAS considers the digestibility of a protein as well as its amino acid score.[5,6]

FAO, Food and Agriculture Organization; UNU, United Nations University; WHO, World Health Organization.

Breaking down protein quality: Digestibility

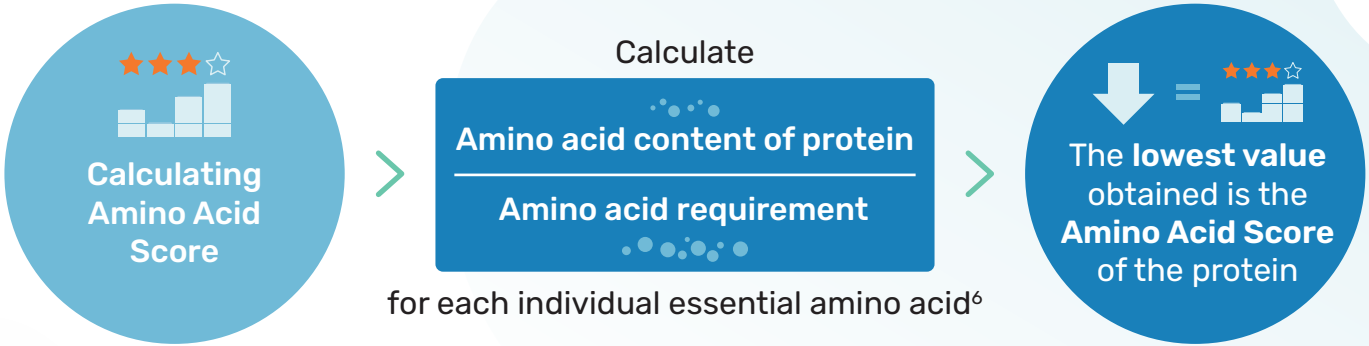
Proteins differ in the amount of amino acids the body is able to digest and absorb. This is known as its protein digestibility.[6] High digestibility means more amino acids are available for protein metabolism and metabolic demands.[6]

The plant and dairy protein sources used in medical nutrition products have very high digestibility rates.[30–32]



Breaking down protein quality: Amino Acid Score

Different protein sources contain different amounts of each amino acid.



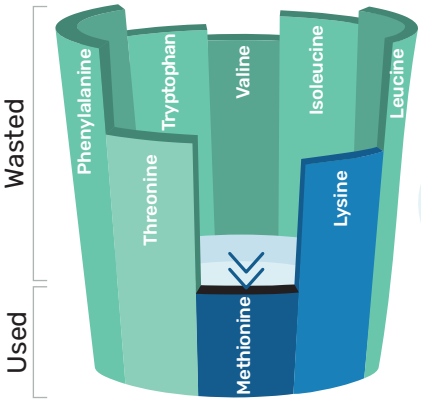
The essential amino acid with the lowest calculated score is the limiting amino acid, and the score is taken to be the Amino Acid Score of the protein source.[6]

Interpreting Amino Acid Scores

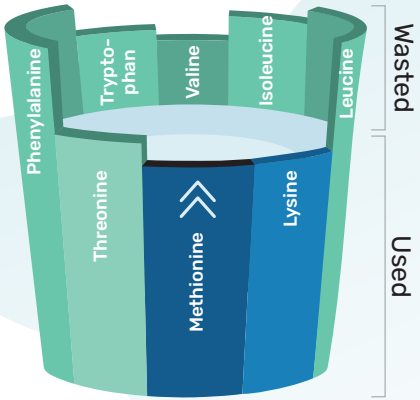
A higher Amino Acid Score indicates that each essential amino acid in the protein is present in the amount needed by the body and is thus being used more effectively.[6]

A score of ≥1 indicates the protein source meets the recommended amounts of essential amino acids.[6]

Low Amino Acid Score



High Amino Acid Score



Protein source (Isolate)	Casein	Whey	Soy	Pea
Amino Acid Score	1.4	1.0	1.1	0.9

Slight variations in AAS possible due to differences in crops, batches, suppliers, analysis methods, processing etc.

Protein Quality of Dairy & Plant Proteins Used in Ons and Tube Feeds

Protein source	Protein digestibility (%)[30–32]	Amino Acid Score[6]	PDCAAS*
Casein	99	1.4	**1.4**
Whey	100	1.0	**1.0**
Soy	98	1.1	**1.1**
Pea	97	0.9	**0.9**

Dairy and plant protein sources used in ONS and tube feeds products have PDCAAS value of 1, indicating high-protein quality.[33]

*Calculated using average digestibility of 98.5% and FAO 2013 amino acid requirement references for adults.[6,30–32]

ONS, oral nutritional supplements; PDCAAS, Protein Digestibility-Corrected Amino Acid Score.

Protein from both dairy and plant sources can meet the standards of protein quality

Providing the **right protein quantity and quality** is crucial in **improving patient outcomes** such as wound healing, strength and physical performance.[34,35]

Protein from **both dairy and plant sources** in tube feed and ONS products can be considered **high quality**, thereby meeting the needs of patients requiring medical nutrition.

ONS, oral nutritional supplements.

Meet your patients' nutritional needs while supporting lifestyle preferences

- Having a range of tube feed and ONS and tube feeds products with different sources or blends of high-quality protein can help to accommodate lifestyle preferences or medical needs of patients.
- ONS containing pea and soy proteins are suitable for vegan diets and can fulfil the nutritional requirements of your patients.

Be confident that your patients' needs can be met with tube and ONS products containing dairy or plant proteins

ONS, oral nutritional supplements.

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