



DIGESTIBILITY SCORES AND AMINO ACID PROFILE OF BARLEY PROTEIN CONCENTRATE

RELEVANCE OF PROTEINS FOR THE HUMAN HEALTH

Proteins have a crucial role in the growth, maintenance, and physiological functions of the human body. Protein quality has been defined by the ability of a dietary protein to meet the body's metabolic needs. The quality of a protein is, therefore, of high relevance in designing healthy foods.

HEALTH BENEFITS OF PROTEIN INTAKE

Growth and tissue repair

Immune function and host defence system

Muscle and skeletal mass

Mental performance, mood, sleep patterns

Detoxication of chemical agents and anti-oxidant system

Figure 1: Health benefits of protein intake¹.

AMINO ACID PROFILE

Evaluation of amino acids profile is fundamental in determining its suitability in the human diet. To assess the protein quality, the amount of protein and the composition of the amino acids, and especially the proportion of essential amino acids (EAA), is important. In 2007, FAO/WHO published

a scoring pattern based on the required EAA (in mg/g protein) needed for adults and children (from 3 to 10 years) (see Table 1). As generally observed in cereals, lysine is the limiting amino acid in barley protein concentrate.

Amino Acid (mg/g protein)	Barley protein concentrate (65% protein)	FAO/WHO 2007 AA requirements*	
		Adults	Children (3-10 years)
Aspartic acid	50.8		
Threonine**	30.8	23	25
Serine	38.5		
Glutamic acid	244.6		
Proline	112.3		
Glycine	29.2		
Alanine	33.8		
Valine**	47.7	39	40
Methionine**	16.9		
Cystine	12.3		
Met+cys	29.2	22	24
Isoleucine **	36.9	30	31
Leucine**	75.4	59	61
Phenylalanine**	58.5		
Tyrosine	29.2		
Phe+tyr	87.7	38	41
Histidine**	29.2	15	16
Lysine**	26.2***	45	48
Tryptophane **	12	6	6.5
Arginine	41.5		

Table 1: Amino acids profile of barley protein.

*Reference: FAO 2013

** The 9 essential amino acids that cannot be synthesized by the body and should be obtained by nutrition.

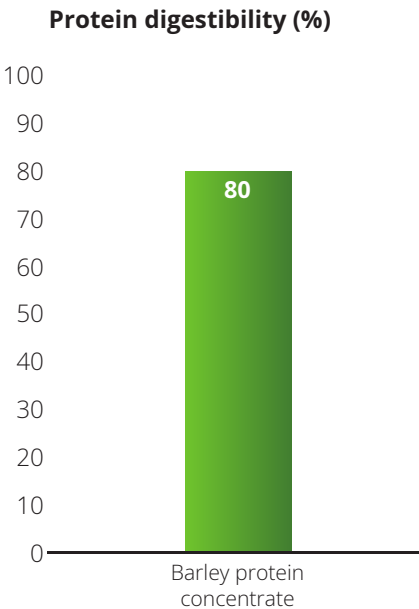
*** The limiting amino acid

PROTEIN DIGESTIBILITY

Protein digestibility represents the part of a protein absorbed from the digestive tract into the bloodstream. It is a key parameter in defining protein availability in a suitable form for protein synthesis in the body.

To evaluate protein digestibility, we used the standardized static digestion procedure, currently known as the INFOGEST protocol. Barley protein concentrate has a high digestibility, with a value of 80%.

Fig 2: Protein digestibility (expressed as amount of Nitrogen in the digested sample/ Nitrogen in the initial protein sample).





PROTEIN DIGESTIBILITY SCORES

Protein Digestibility-Corrected Amino Acid Score (PDCAAS) and Digestible Indispensable Amino Acid Score (DIAAS) are the two key evaluation techniques to determine the protein quality by considering the specific composition of essential amino acids.

The protein digestibility-corrected amino acid score (PDCAAS) has been adopted by FAO/WHO since 1991 as the preferred method for the measurement of the protein value in human nutrition. The method is based on the ratio of the amount of the first-limiting dietary indispensable amino acid in the protein source to the amino acid requirement of the 1–2-y-old child corrected for protein digestibility based on true fecal nitrogen digestibility and using the growing rat as a model for the adult human. Although the principle of the PDCAAS method has been widely accepted, critical questions have

been raised regarding i) the accuracy of fecal instead of ileal digestibility, ii) the validity of the amino acid requirements of the 1–2-y-old child and iii) the truncation of PDCAAS to 100%

Therefore, the FAO¹ has recommended replacing the protein digestibility-corrected amino acid score (PDCAAS) with the digestible indispensable amino acid score (DIAAS). DIAAS is based on true ileal amino acid digestibility determined for each amino acid individually, and Lys availability estimates, using nontruncated scores (i.e., DIAAS can be higher than 100%).

The protein scoring (DIAAS and PDCAAS) of barley protein is comparable to other proteins deriving from cereals such as wheat (DIAAS=20; PDCAAS=42) and rice (DIAAS=37; PDCAAS=42).

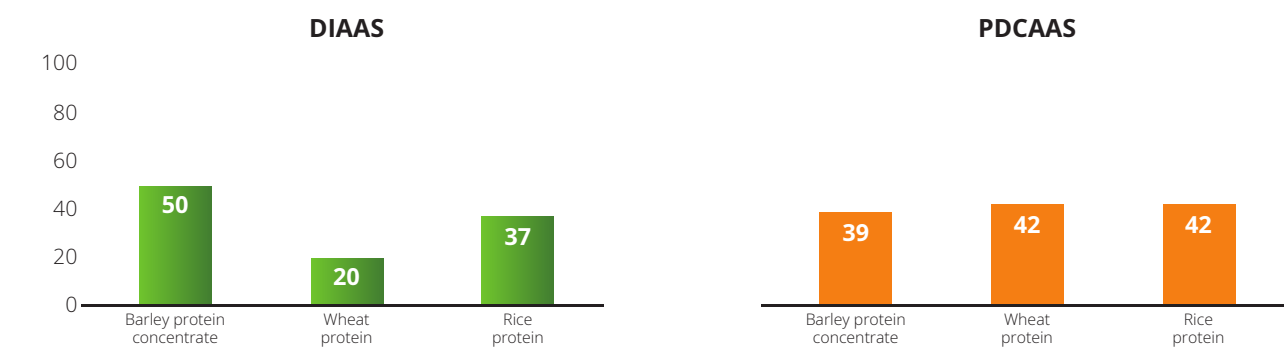


Table 2: Protein scoring (DIAAS and PDCAAS) of barley protein.

DIAAS (%) = 100 x lowest value [(mg of digestible dietary indispensable amino acid in 1 g of the dietary protein)/(mg of the same dietary indispensable amino acid in 1g of the reference protein)]

PDCAAS (%) = [mg of limiting amino acid in 1 g of test protein/ mg of same amino acid in 1 g of reference protein] × fecal true digestibility (%)×100

References

1 FAO (2013). Dietary protein quality evaluation in human nutrition. Report of an FAO Expert Consultation. FAO food and nutrition paper no. 92, FAO, Rome (Italy). <https://www.fao.org/ag/humannutrition/35978-02317b979a686a57aa4593304ffc17f06.pdf>