Amino Acid Scoring

Amino acid scoring provides a way to predict how efficiently protein will meet a person's amino acid needs. This concept assumes that tissue protein synthesis is limited unless all required amino acids are available at the same time and in appropriate amounts at the site of tissue protein synthesis.

A reference amino acid scoring pattern is used, which expresses the amino acids requirements in milligrams/gram of dietary protein or as percentages in an "ideal" protein. For example, if the lysine content of a whole-wheat flour is 2.6% and the value for lysine in the scoring pattern for a young child is 5.1%, you would calculate $2.6/5.1 \times 100 = 51$. If 51 is the lowest score among all of the amino acids in whole-wheat flour, it is named the "limiting amino acid," and the amino acid score for wheat proteins would equal 51. The score for whole egg proteins is 100, so a child would have to consume twice as much protein from whole wheat as from eggs.

A group of consultants from the Food and Agriculture Organization of the United Nations (FAO)/World Health Organization (WHO) suggested discontinuation of the use of the amino acid scoring patterns for school-age children and adults. It recommended the use of the amino acid scoring pattern for children of preschool age to evaluate protein quality for all age groups except infants. The pattern used for infants is based on the amino acid composition of human milk.

Protein intake

For the population of industrialized nations, the intake of protein far surpasses the recommended amount. Older children and adults have little chance of not meeting their amino acid and protein nitrogen needs. The only people who really need to worry about the quality of their protein are those who eat very little protein and that is rare.

Protein digestibility-corrected amino acid score (PDCAAS)

Amino acid scoring does not take protein digestibility into account. Therefore, it is useful for comparing animal products and refined foods that are not excessively heated. However, because plant foods are not completely digested, it is necessary to make a correction to the calculation.

The PDCAAS was adopted by FAO/WHO as the preferred method for measuring protein value in human nutrition. It is calculated by comparing the concentration of the first limiting essential amino acid in the test protein with the concentration of that amino acid in the scoring pattern, and then correcting for true fecal digestibility of the test protein.

The three concerns about the PDCAAS are:

- The validity of the preschool-age child amino acid requirements
- The validity of correcting the score based on fecal digestibility, instead of ileal digestibility
  - "Fecal digestibility overestimates the nutritional value of a protein, because amino acid nitrogen entering the colon is lost for protein synthesis in the body and is, at least in part, excreted in urine as ammonia" (Schaafsma G)
- PDCAAS values larger than 100 are currently truncated to 100

Suggested Amino Acid Scoring Patterns (mg/g Protein)		
	Infant	**Preschool Child**
Histidine	26	(19)
Isoleucine	46	28
Leucine	93	66
Lysine	66	58
Methionine + Cystine	42	25
Phenylalanine + Tyrosine	72	63
Threonine	43	34
Tryptophan	17	11
Valine	55	35
TOTAL	460	339

Histidine value in parenthesis obtained from interpolation from smooth curve of requirement (Harper AE, Yoshimura NN).

g=gram, mg=milligram

The perfect score?

If you ate a food with an amino acid score of 75 and ate another food with an amino acid score of 25, would your meal have a perfect amino acid score? Unfortunately, it is not that easy. The amino acids would have to compliment each other perfectly, and the chances of this occurring are slim.

References and recommended readings

Harper AE, Yoshimura NN. Amino acid balance and use in the body. Available at: http://www.oralchelation.com/technical/amino1.htm#11. Accessed July 28, 2010.

Schaafsma G. The protein digestibility amino acid score. *J Nutr* [serial online]. 2000;130:1865S-1867S. Available at: http://jn.nutrition.org/cgi/content/full/130/7/1865S. Accessed July 28, 2010.

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