Essential amino acids: master regulators of nutrition and environmental footprint?

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Abstract

The relationships between the environmental footprint and food production (and human consumption) is at the core of current debates. Indeed, the world-wide effort to reduce the footprint of any economical, industrial, and agricultural activity is mandatory nowadays, given the increasing and undesired warming effects associated to the planet's anthropization.
Dietary choices are an important factor determining the global warming. Food production accounts for ≈25-30% of total GHGE (Green House Gas Emission) in Europe.
A commonly accepted concept is that the environmental footprint associated to the production of animal food is several-fold greater than that associated to crops cultivation. Therefore, the choice between animal and vegetarian diets may have a relevant environmental impact. In such comparisons however, the nutritional value of foods is not sufficiently considered and/or taken into account. Furthermore, traditional estimates of nutrients' environmental footprint had predominantly been based on either food raw weight or their caloric content, without considering human requirements.
Essential substrates are by definition key nutritional elements to be considered in diet planning. Among them, the requirements of all the essential amino acids (EAAs) need to be guaranteed in food provision, and therefore should constitute key factors in quality assessment. Recently, we have analyzed the environmental footprint, expressed both as the land used for production and as the associated Green House Gas Emission (GHGE), of some staple animal and vegetal foods, titrated to amounts providing the Recommended Daily Allowances (RDA) of all the EAAs in humans. An extensive data search across peer-reviewed journal, of published estimates of the environmental footprint of food production, has been carried out. The authors' use of life cycle assessment (LCA) methodology has been accurately verified before literary sources' selection.
Our results show that the production of high-quality animal proteins, in amounts sufficient to comply with the Recommended Daily Allowances of all the EAAs, would require a land use and a GHGE approximately equal, greater (however by only ≈1-fold) or even smaller, than that necessary to produce vegetal proteins. An exception is that of soybeans, that exhibited the smallest footprint being rich of EAA in sufficiently balanced proportion too. Furthermore, the energy content of the calculated food amounts was much lower when associated to animal that to vegetal foods (except for soybeans again).
When human requirements of EAAs are used for reference, this new analysis places into a wider, more critical perspective the common concept of a large advantage, in respect to the environmental footprint, of crops vs. animal food production. Furthermore, the lower caloric content of animal than vegetal foods could be considered while designing diet aimed at reducing overweight and obesity.