
Volcanic proteins: *Galdieria sulphuraria* protein profile and bioaccessibility

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Galdieria sulphuraria is considered one of the most promising microalgae for food applications. *G. sulphuraria* can uptake inorganic carbon CO₂ as well as more than 30 organic carbon sources. The extreme growing conditions such as low pH (as low as 0.2), high temperature (up to 57 °C) and osmotic pressure (2-3 M), can be used to create a selective environment that prevents the proliferation of unwanted microorganisms. *G. sulphuraria* is rich in proteins (65% w/w) and it might contain up to 10% w/w of the blue pigment phycocyanin.

Nevertheless, amino acid composition and overall protein fraction are not the only characteristics that make a protein source suitable for human consumption. Protein bioaccessibility can be defined as the quantity or fraction of a protein that is released from the food matrix in the gastrointestinal tract and becomes available for absorption and it is as important as the quantity of the protein fraction. In this study, we compared two strains of *G. sulphuraria* cultivated autotrophically and mixotrophically over a month in pilot-scale photobioreactors under nonsterile conditions. During mixotrophic cultivation, a constant supply of glucose was provided as the sole carbon source. An in vitro digestion model was used to measure protein bioaccessibility, following the harmonized protocol INFOGEST 2.0. The low pH (<1.9) used for cultivation successfully prevented microbial contamination. The two strains had similar autotrophic (13 g·m⁻²·day⁻¹) and mixotrophic biomass productivities (30 g·m⁻²·day⁻¹). Comparing the biomass composition of the two strains, *G. sulphuraria* SAG 108.79 and ACUF 064 had 51% and 64% (w/w) protein and 4% and 9% (w/w) C-phycocyanin content, respectively. Interestingly, *G. sulphuraria* SAG108.79 showed a protein bioaccessibility of 62% (w/w), in line with other microalgal species, whereas *G. sulphuraria* ACUF064 had a protein bioaccessibility of only 14% (w/w). No differences in the amino acid profile were found between the two strains or between trophic modes. The amino acid profile was well-balanced, rich in all the essential amino acids, especially methionine and cysteine, fulfilling FAO dietary requirements for adults. Stable and well-balanced protein profiles are encouraging results for future food applications of this species.