Biochemical characterization and in vitro digestibility of microalgal and cyanobacterial biomasses as novel ingredients for food products

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Due to their valuable and balanced biochemical composition, microalgae (including cyanobacteria) have a long history of use as foods, but so far only few species are approvedas food and applied in the food industry. A deep investigation on quality and safety of microalgae is necessary to increase their exploitation as ingredients in functional foodsand/or nutraceuticals. In particular, the knowledge oftheir nutrient profile and in vitro digestibility is fundamental to provide information about the quality and bioavailabilityof nutritional constituents of microalgal biomasses [1].
The aim of this study was to investigate the biochemical composition and the in vitro digestibility of 10 cultivated microalgae and one natural bloomof interest as food source. All biomasses were analysed for protein, carbohydrate, lipid and fatty acid profile, total dietary fiber, ash, moisture and total phenolic content. The in vitro digestibility was performed by an enzymatic method using pepsin and pancreatin [2].
Cyanobacteria and most of the freshwater algal species showed higher protein contents (up to 69% in Arthrospira platensis). Marine microalgae showed high amounts of long chain polyunsaturated fatty acids, mainly C20:5 w3 (eicosapentaenoic acid, EPA) and C22:6 w3 (docosahexaenoic acid, DHA), whereas freshwater species to be rich in C18:3 w3 (α-linolenic acid, ALA). The nutritional quality of the lipid fraction evaluated by different indexes indicatedthat most of the species tested are desirablein the human diet, due to their potential in decreasing blood cholesterol.
Cyanobacteria showed the highest digestibility in terms of dry matter (DMD), organic matter (OMD), carbohydrate (CD) and crude protein (CPD). The two green microalgae (*Chlorella sorokiniana* and *Tetraselmis suecica*), *Nannochloropsis oceanica*, *Phaeodactylum tricornutum* and *Porphyridium purpureum* showed lower digestibility values, mainly due to their robust cell wall or tothe presence of exopolysaccharides that limit the action of digestive enzymes. Despite fiber can entrap proteins in the cellular matrix makingthem less bioavailable to enzymatic hydrolysis, no significant correlation between CPD and dietary fiber wasfound. Microalgae rich in fiber always showed significantly lower DMD, OMD, and CD values.
Our study represents the starting point for the selection of the most suitable microalgae for specific food applications and successful novel foods development. A balanced biochemical composition and a good digestibility, in particular for cyanobacteria, indicate that these microorganisms are promising sources of biomass and components for functional foods. Cell wall disruption is necessary to increase digestibility of the most robust strains.

References

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