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Alternative Protein Sources and Strategic Approaches to Sustainable Production in Portugal: A Review

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Abstract

Global population growth and increasing health awareness are sharply intensifying the demand for sustainable protein sources[1]. Yet, current dependence on animal-based proteins is increasingly untenable: conventional livestock systems exert heavy pressure on land, water, and ecosystems, while contributing substantially to greenhouse gas emissions. As a result, the transition toward alternative proteins has become an urgent scientific and societal priority[2]. Emerging protein sources, including those derived from plants, insects, algae, bacteria and fungi offer promising nutritional profiles and markedly lower environmental footprints[3]. These protein sources vary widely in composition, functional properties, and scalability, and their successful integration into the food system depends on optimized extraction technologies and processing[4]. In Portugal, the presence of native plants and vegetables (e.g. L*athyrus sativus* and S*alicornia europaea*), forage grasses (e.g. *Dactylis glomerata* and *Festuca pratensis*), fungi (e.g. *Lactarius deliciosus* and *Tricholoma equestre*), and a vast selection of edible algae from an extensive coastline, shows strong potential for high-value, sustainable protein production. Leveraging and valorising these endogenous materials and byproducts can accelerate the diversification of protein supply chains and support the development of resilient, nutritious, and climate-responsible food systems. This review aims to critically assess the potential of these alternative protein sources, with particular emphasis on extraction strategies, functional properties, and opportunities for local resource valorisation.

Keywords: Alternative proteins, livestock alternatives, protein extraction, plant-based, valorisation

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