

Recent decades have witnessed increased interest in the production and utilization of gluten-free food products from underutilized plant sources to overcome the health concerns associated with gluten-containing foods. In addition, global warming and shortage of water supply have also directed the research toward utilizing tolerant plants as potential sources of food, feed, cosmetic, and pharmaceutical products. In this regard, the samh (*Mesembryanthemum forsskalei* Hochst) plant is considered a suitable candidate that could be exploited in food and pharmaceutical applications. Samh is a halophyte plant that grows naturally in the semi-arid zones of Northern Africa and the Middle East and in many countries around the world. Samh is extremely tolerant to harsh desert environments, such as elevated temperatures, the salinity of soil and water, and limited water resources. This has subsequently led to demands for its cultivation and utilization to increase in recent years. Prior to consumption and use, samh seeds undergo several processing treatments to improve their sensory attributes and nutritional quality. Of these processes, roasting, boiling, baking, and cooking have been commonly used to reduce the antinutritional factors, enhance the chemical composition and *in vitro* and *in vivo* protein digestion, improve biological value, and consequently enhance the nutritional and health properties of samh seeds. Roasted seeds are milled to form fine flour and then applied as a supplement or substitute to wheat flour in bakery products such as bread and cookies to enhance their nutritional and sensory attributes. However, like other grains, complete utilization and capture of the benefits of samh seeds are hindered by the existence of antinutritional factors such as phytates, tannins, and trypsin inhibitors. Therefore, the main goal of this study is to investigate the influence of fermentation and germination on the fatty acids, amino acids, minerals, and physicochemical, functional, and bioactive quality attributes of samh seeds. Roasting treatment was found to improve the antioxidant activity and phenolic acids, flavonoid, linoleic acid, potassium, and calcium contents of samh seeds. Therefore Non-thermal processing, such as germination and fermentation, are powerful methods that could be used to improve the nutritional, sensorial, and health quality of foods.