

ABSTRACT

The aim of this doctoral thesis was the development and characterisation of fermented vegetable beverages (most known as vegetable *milks*) derived from almond, hazelnut and oat, which were selected owing to their compositional and nutritional values. Potentially probiotic strains were used in order to obtain functional fermented products, not only able to exert health benefits, but also as an alternative to dairy based products.

Firstly, the processing conditions to ensure the physical stability and microbiological safety of *milks* were analysed. The *milks* from tree nuts have a high fat content, which causes physical stability problems related to the phase separation phenomena. The application of high homogenisation pressures (around 100 MPa) together with heat treatments markedly improved the stability of both fermented and non-fermented nut *milks*. On the other side, in oat *milk*, the β -glucans present provides a great physical stability after the heat treatment due to its gelling and thickening capacity, not showing thus physical stability problems. Furthermore, the prebiotic properties of β -glucans (the ability to stimulate the growth of beneficial bacteria in our gut microflora) give the finished product significant added value.

For the design and optimisation of the fermented processing by using probiotic bacteria, the effect of several growth factors (glucose, fructose, inulin and inoculum additions) on the probiotic survivals within the vegetable matrices was studied, since a minimum concentration of 10^7 colonies forming units per mL is recommended to consider the product as a functional food. After this study, an optimal *milk* formulation was determined, where a fast fermentation time was attained and high probiotic survivals were ensured. When similar probiotic survival responses were obtained, minimum levels of each growth factor were chosen in order to favour a low-cost production. Afterwards, the fermented products were characterised at different storage times (1, 7, 14, 21 and 28 days) at 4 °C to analyse how storage time affect their main physicochemical and sensory properties and probiotic survivals; hence, an optimal period of storage time was defined. Results showed that the *milks* fermented with the selected potentially probiotic microorganisms were able to maintain a high viability, physical stability and sensory appreciation throughout the cold storage time, being the shelf life similar to that of standard yoghurts.

One of the healthy properties that probiotics can provide is the ability to positively influence the immune system, thus preventing the occurrence of allergic reactions, among other effects. Almond is a nut highly consumed but it contains allergens; hence, probiotic bacteria might be a good tool to reduce its allergic response. Therefore, *in vitro* studies of the inflammatory properties of fermented almond *milk* with different potentially probiotic microorganisms were carried out. These studies showed positive effects in some of the strains used, which were able to decrease the initial allergic response associated to the non-fermented *milk*. These results offer new interesting expectations to continue with this research line and more *in vitro* and *in vivo* studies with sensitised populations are needed.