Development and characterization of a functional fresh cheese from goat's milk enriched with inulin and olive leaf extract

Introduction. Current market demands focus on foods with high nutritional properties and consistent quality. In this context, standardizing the natural milk components of milk, combined with the application of ultrafiltration can help reduce variability in the final product's composition. Among functional ingredients, there is growing interest in prebiotic fibers (e.g. inulin) and polyphenols, of which the latter are bioactive compounds known for their antioxidant, anti-inflammatory and other nutraceutical properties. Olive leaves, a byproduct of olive cultivation chain, are characterized by a high polyphenol content. Therefore, the main objective of this study was to develop and characterize a fresh goat's milk cheese (FC) with a predefined physico-chemical and nutritional composition enriched with a polyphenol-rich olive leaf extract (OLE) and inulin.

Methods. The technological process involved the use of a formulated milk obtained by mixing predefined amounts of whole goat milk, goat skim milk concentrated by ultrafiltration (retentate), and goat milk cream, together with 2% inulin and a phenolic extract derived from olive leaves containing 1300 mg Gallic Acid Equivalents (GAE) 100 g^{-1} of total polyphenols (TP). Three formulations with different TP concentrations were prepared: a control (FCC) with no added polyphenols, FC1 with 10 mg GAE 100 g^{-1} of milk and FC2 with 20 mg GAE 100 g^{-1} of milk. The milk was then homogenized, pasteurized, cooled and inoculated with a freeze-dried starter culture, followed by the addition of a small amount of rennet. This allowed for acid-rennet coagulation directly in the final package. The resulting products were analyzed for TP content, and chemical-nutritional, microbiological, and sensory properties.

Results. The fresh cheeses obtained were characterized by the complete absence of whey separation, indicating that the process developed achieved a high yield while ensuring the full recovery of the nutritional elements available in the starting milk, including added nutrients such as inulin and polyphenols. The addition of OLE did not negatively affect the fermentation activity and survival of the starter bacteria or the physico-chemical characteristics. OLE-enriched cheeses showed TP recovery rates of 57% (FC1) and 53% (FC2) compared with pre-established supplementation levels. The inclusion of OLE resulted in a dose-dependent increase in the total antioxidant capacity of the cheeses. OLE-integrated products also showed a slight increase in hardness and consistency as well as a small difference in color compared to FCC, which were more pronounced in FC2. The addition of OLE showed a dose-dependent effect also on the sensory properties of fresh cheeses, leading to significant differences in FC2 in terms of both acceptability and perceived attributes, whereas these differences were not observed in FC1 cheese compared to the control.

Conclusions. The results of this work indicate that the cheesemaking process developed is suitable for producing a dairy matrix that effectively incorporates functional ingredients. Moreover, the study suggests that using a polyphenol-rich extract obtained from olive leaves can enhance the nutritional value of dairy products. However, additional research is necessary to optimize the dosage and address the sensory differences observed.

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