

Use of the addition of antimicrobials, bioprotectors and direct acidification to extend the shelf life of sheep and goat cheese whey under refrigeration

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Sheep's cheese whey (SCW) and goat's cheese whey (GCW) are by-products of cheese production and, on small farms, are not used properly due to small volumes and lack of knowledge on how to process it. Thus, these by-products are destined for animal feed or discharged, reducing the income of producers, and causing environmental concerns. Microbiological stabilization with consequent extension of shelf life is the first step to add value to these products. Considering the need of simple solutions for application in artisanal production, we evaluated the effectiveness of nisin, *Lactocaseibacillus casei* addition as bioprotective culture, and direct acidification with lactic acid (up to pH 4.5, 3.5, and 2.5) as tools to guarantee the stability of pasteurized (75°C/5min) SCW and GCW for 28 days at 7 °C. The results showed that nisin and acidification at pH 3.5 and 2.5 maintained mesophilic and psychrotrophic bacteria counts below 1 log CFU/mL, with stable pH and acidity during samples storage. Inoculation with *L. casei* was also effective, reaching 7-8 log CFU/mL and protecting the samples with slight (SCW) or no acidification (GCW); whereas samples with pH 4.5 and control (only pasteurized) had a slight (~2-3 log CFU/mL) and expressive growth (?8 log CFU/mL), respectively. Regarding the physical stability measured in the static experiment, all samples destabilized, but those acidified at pH 3.5 and 4.5 had a higher rate of phase separation and greater cream formation (up to 30%) and sediments (up to 6 %). Conversely, the particle size data showed little difference between treatments (0 and 28 days of storage) for both whey sources, suggesting that the interactions of the particle responsible for physical stabilization were disrupted by agitation performed before the particle size measurement. The final evaluation of the results highlighted the addition of nisin and the inoculation of *L. casei* as effective barriers to prevent SCW and GCW spoilage, while acidification needs to be carefully evaluated due to the high amount of acid (6.6-7.7 v/v of lactic acid 40%) required to reach pH 2.5, the low stability observed at pH 3.5 and 4.5, and vulnerability of samples to contamination at pH 4.5.