

We closely follow the advice and guidance offered by Neal's Yard Dairy with respect to the "THE RELATIONSHIP BETWEEN TEMPERATURE AND FOOD SAFETY IN RIPENED CHEESE"

Cheesemaking involves the acidification of milk and the precipitation of protein and other solids as curd while excess moisture is run off as whey. In short, cheese is preserved milk.

Although there are distinct differences in food safety risk analyses between hard cheeses (typically 33 – 44% moisture) and soft cheeses (typically greater than 45%) and more subtle considerations to consider between methods of manufacture and types of cheese, there are seven fundamental preservation factors which extend shelf-life and inhibit undesirable or pathogenic bacteria.

The seven fundamental preservation factors in cheese are:

1. The fermentation of milk sugar, lactose, into lactic acid by selected lactic acid bacteria.
2. The preservation properties of organic acids, such as lactic acid, which inhibit pathogens.
3. The dominance of lactic acid bacteria and ripening microorganisms in the cheese, which provides competitive inhibition of other species (the Jameson Effect).
4. The reduction of moisture from approximately 89% in milk to as low as 33% in the final product, depending on the type of cheese.
5. The reduction of available moisture (a_w) by the addition of salt.
6. Other metabolites of starter bacteria which inhibit pathogens and spoilage microbes, e.g. the production of the inhibitory bacteriocin nisin by lactobacilli.
7. To a lesser extent, other inhibitory elements in milk, such as lactoperoxidase and lactoferrin.

Refrigeration temperatures have limited utility for the preservation of cheese and as a critical control in its safety because:

1. Low temperatures inhibit the growth of lactic acid bacteria and compromise their dominance within the cheese.
2. The mesophilic pathogens (*Salmonella*, *Listeria*, and *Staphylococcus aureus*) may be destroyed and are at least inhibited by lactic acid in hard-pressed mature cheese. Likewise, toxigenic *E. coli* species die off over time in hard aged cheeses kept at maturation temperature.
3. In the case of *Staphylococcus aureus*, illness is caused by the production of toxins. Refrigeration has no effect on toxins once they have been produced. Emphasis is therefore placed upon animal health and acidity development during manufacture (slow vat procedures are in place where appropriate). As an acknowledgement of this, the Microbiological Standards Regulations

(EC/2073/2005) require testing for Staph toxins soon after manufacture when numbers are likely to be highest.

4. Food-borne *Listeria monocytogenes* and some strains of *E. coli* are psychrotrophic and may still grow, albeit at a reduced rate, at refrigeration temperatures.
5. Spoilage moulds can grow at refrigeration temperatures and are best controlled by proper cheesemaking and absence of physical damage due to careless handling.