

Effect of Non-Thermal Processing on Nutrient Retention in Dairy and Food Products

Susana Bode*

Department of Food Science, University of Guelph, Guelph, Canada

Opinion

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***For Correspondence:**

Susana Bode, Department of Food Science, University of Guelph, Guelph, Canada

E-mail: Susana_bode@outlook.com

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DESCRIPTION

Non-thermal processing technologies have emerged as essential tools in the food and dairy industries, offering an alternative to traditional thermal methods. These innovative techniques are designed to preserve the nutritional content, taste, and safety of food products while minimizing the detrimental effects associated with high heat treatments. The need for non-thermal methods has grown as consumers increasingly demand food products that retain their natural nutrients and offer better taste profiles. This article explores the effect of non-thermal processing on nutrient retention in dairy and food products and highlights the advantages and challenges of these methods.

Non-thermal processing refers to any method of food preservation or processing that does not involve the application of heat. These methods include techniques such as High-Pressure Processing (HPP), Pulsed Electric Fields (PEF), Ultraviolet (UV) light, irradiation, and cold plasma. Unlike thermal treatments, which can degrade heat-sensitive nutrients and alter food textures, non-thermal processes generally preserve the nutritional value of food products more effectively.

Dairy products, such as milk, yogurt, cheese, and butter, are rich in essential nutrients, including proteins, fats, vitamins, and minerals. However, the conventional thermal processing methods like pasteurization and Ultra-High Temperature (UHT) processing can result in the loss of these nutrients. Non-thermal processing technologies aim to mitigate such nutrient loss.

Pulsed Electric Fields (PEF) use short bursts of high voltage to disrupt the cell membranes of microorganisms, effectively sterilizing the product. In dairy products, PEF has been shown to preserve vitamins, minerals, and proteins better than conventional thermal treatments. For example, PEF treatment of milk can significantly reduce the loss of heat-sensitive nutrients, such as vitamin C and some B vitamins, while still achieving pasteurization levels that ensure safety.

Ultraviolet light is commonly used for disinfecting surfaces and liquids in the food industry, and it is particularly useful for treating dairy beverages like milk and juice. UV light kills harmful pathogens by disrupting their DNA, while having minimal effect on nutrients. Studies have demonstrated that UV-treated milk retains its levels of vitamins and minerals, including vitamin D, calcium, and riboflavin, much better than milk subjected to traditional pasteurization. UV light also preserves the flavor of dairy products, as it does not cause the Maillard reaction or caramelization, which often occur in thermal treatments. Consequently, UV treatment helps maintain the natural taste and quality of dairy beverages.

Non-thermal processing methods such as HPP, PEF, and UV light are particularly beneficial for preserving the nutritional value of fruits and vegetables, which are prone to nutrient loss during traditional heat processing. Vitamins such as vitamin C, carotenoids, and folates are highly sensitive to heat and can degrade during conventional pasteurization or canning processes.

Non-thermal processing is increasingly used in the production of fruit juices and smoothies, where nutrient retention is a key concern. HPP, in particular, has been shown to significantly preserve the levels of vitamins (such as vitamin C and folate), minerals, and polyphenols in juices, preventing oxidation and nutrient degradation. As a result, cold-pressed and HPP juices often have a higher nutritional value than their thermally treated counterparts.

In the meat industry, non-thermal methods like high-pressure processing and irradiation are used to improve the shelf life of products while preserving essential nutrients like protein, iron, and B vitamins. Unlike traditional heat treatments, which can cause significant losses of these nutrients, non-thermal technologies allow for more gentle processing that retains the nutritional integrity of meat products.

Non-thermal processing methods represent a promising alternative to conventional heat treatments in the dairy and food industries, offering significant benefits in terms of nutrient retention, flavor preservation, and shelf-life extension. These methods allow for the production of healthier, more nutritious food and beverage products that align with consumer demand for clean-label, minimally processed foods. As technology continues to evolve, non-thermal processing will likely play an even more significant role in ensuring food safety and quality while retaining the maximum nutritional value of the products.