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Bioactive Compounds in Swiss Cheese

The complex microflora and the strong proteolysis contribute to the formation of an important number of peptides during cheese ripening. Some of these peptides are known to be biologically active and may have a positive impact on health. Among them the best investigated bioactive peptides are those showing an antihypertensive effect. The contents of two such antihypertensive peptides namely Val-Pro-Pro (VPP) and Ile-Pro-Pro (IPP) were determined in 10 different Swiss cheese varieties using HPLC with subsequent triple mass spectrometry. In individual samples, the total concentration of VPP and IPP varied between 1.6 and 424.5 mg/kg. In most cheeses VPP was present at greater concentrations than IPP. Key factors such as milk pretreatment, cultures, scalding conditions, and ripening time were identified to influence the concentration of these two naturally occurring bioactive peptides in cheese.

In another study the angiotensin-converting enzyme (ACE)-inhibitory activity as well as the concentration of the two ACE-inhibiting tripeptides Val-Pro-Pro (VPP) and Ile-Pro-Pro (IPP) were studied during cheese ripening in seven Swiss cheese varieties. Good correlation was found between the ACE-inhibitory activity and the total concentration of VPP and IPP at advanced ripening stages. In most of the investigated varieties the ACE-inhibitory activity as well as the concentrations of the two tripeptides initially increased during ripening time. The chemical characterization of the investigated cheeses revealed that qualitative differences in the proteolysis pattern rather than quantitative differences in the degree of proteolysis are responsible for the observed variations in the concentrations of VPP and IPP. The presence of *Lactobacillus helveticus* in the starter culture was also associated with elevated concentrations of VPP and IPP.

In an in vivo study the effect of cheese containing either high or low contents of VPP and IPP and corresponding concentrations of synthetic tripeptides on blood pressure of spontaneously hypertensive rats (SHR) were investigated using a telemetry system. Unlike the findings of several other studies using tail-cuff systems, neither cheese nor synthetic lactotriptides had a significant effect on blood pressure in SHR.

Unlike the positive effects of bioactive peptides, the release of free amino acids and their further degradation to biogenic amines during cheese ripening is associated with

adverse effects on human health. In cheese usually histamine, tyramine, cadaverine and putrescine can be found in elevated concentrations. In healthy subjects these amines are enzymatically degraded in the intestinal mucosa. However, patients sensitive to biogenic amines may react with circulatory disturbance or other health problems after consumption of foods with moderate to high concentrations of biogenic amines. Cheeses made from raw milk are often reported to contain high concentrations of biogenic amines. In recent work several varieties of Swiss origin were investigated for their content of biogenic amines. The results indicate that usual levels are rather low but that exceptions may occur. The factors influencing the development of biogenic amines are not fully understood, but it seems that raw milk flora and/or persistent flora in cheese factories are responsible for the formation of unusual high concentrations of biogenic amines in cheese during ripening.