

## MICROBIAL GROWTH AND BIOGENIC AMINES FORMATION IN KASHKAVAL CHEESE

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### Abstract

Cheese is known to be a suitable medium for the production of biogenic amines, as it contains proteins, enzymes, cofactors, water and microorganisms. While the content of biogenic amines in milk is very low (1 mg/dm<sup>3</sup>), their presence in cheese is significantly higher (1g/kg). The accumulation of biogenic amines in cheese can be influenced in the first place by the degree of microbial contamination of raw milk, production hygiene, starter cultures used, environmental conditions, temperature and duration of ripening. It has been found that microbiological changes can lead to an increase in the enzyme decarboxylase and the concentration of biogenic amines in food, respectively. Therefore, the aim of the present study was to establish the influence of different storage temperatures on microbial growth and biogenic amines formation in Bulgarian Kashkaval cheese.

Kashkaval samples, used in this research, were produced under industrial conditions in the company "Bor Chvor" Ltd. Storage was conducted at different temperatures (refrigerated at  $4 \pm 1$  °C; refrigerated at  $1 \pm 1$  °C; superchilled at  $-7.5 \pm 0.5$  °C and frozen at  $-18 \pm 1$  °C) for 12 months. The analysis of biogenic amines was performed by liquid chromatograph equipped with UV detector and Spherisorb ODS2. The total number of viable cells *Streptococcus* spp. and *Lactobacillus delbrueckii* spp. in the studied Kashkaval samples was determined by cultivation on synthetic culture media (M17 and MRS). Statistical analyses were carried out on the averages of the triplicate results. Two-way multivariate analysis of variance (MANOVA) and multiple comparison tests were carried out to study the effect of both storage time and temperature on the physicochemical and microbiological characteristics of Kashkaval samples.

Higher levels ( $P < 0.05$ ) of proteolysis were established in the Kashkaval cheese samples stored at higher temperatures ( $4 \pm 1$  °C). The temperature regime of storage is crucial for the development of the starter and non-starter lactic acid microflora in the Kashkaval cheese. A decrease in the number of lactic acid bacteria was found during the storage of Kashkaval cheese in superchilled and frozen state. No significant ( $P > 0.05$ ) changes on the number of lactic acid bacteria of the Kashkaval cheese during the 12-month period of storage in a refrigerated state at  $4 \pm 1$  °C and  $1 \pm 1$  °C was observed. Refrigerated storage of Kashkaval cheese at temperatures below 1 °C leads to inhibition of the processes leading to the formation of biogenic amines. At higher temperatures ( $4 \pm 1$  °C), although very slowly, this process takes place, which is accompanied by the accumulation of mainly the biogenic amines tyramine and putrescine.

The content of biogenic amines in the cheese should be used as an indicator to control the effectiveness of the applied refrigeration storage regimes.

**Key words:** *Biogenic amines, Kashkaval cheese, Microbial growth, Refrigeration storage regimes.*