Mini Review

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Lactobacillus helveticus-a brief overview of thermophilic lactic acid bacteria

Abstract

Generally *Lactobacillus helveticus* is an obligately homofermentative lactic acid bacterium that is widely used as a starter culture to manufacture set type yoghurt andcertain cheeses and also as a flavor enhancingadjunct culture for some cheese types. This review usage possibilities of *Lb.helveticus* will be revised shortly.

Keywords: low fat cheese, ACE inhibitor, Autolysis, cheese flavor, S layer

Volume 4 Issue 6 - 2017

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Received: June 18, 2016 | **Published:** September 15, 2017

Abbreviations: *Lb.helveticus*, *lactobacillus helveticus;* LAB, lactic acid bacteria; ACE, angiotensin converting enzyme; ACE-I, angiotensin converting enzyme ınhibitors

Introduction

Raw material-associated lactic acid bacteria (LAB) have an essential role in the nutritious and organoleptic properties of fermented milk production.[1] *Lb. helveticus* is a lactic-acid producing, rod shaped bacterium of the genus *Lactobacillus*. It is most commonly used in the production of Swiss type cheese, aged Italian and Emmental cheese. In Emmental cheese production *Lb. helveticus* is used in conjunction with a *Propionibacter* culture, which is responsible for "eyes" through production of carbon dioxide gas. *Lb. helveticus* has been shown to possess strong proteolytic activity in milk-based media.[2] *Lb. helveticus* growoptimumat pH 5.5 to 5.8 and 42 to 45°C. Surface layer proteins constitute the outermost structure of the cell envelope, which is an array of single non-covalently bound proteins.[3] The biological functions of surface layer proteins are cell protection, determination of cell shape, molecular and ion trapping, and adhesion to surfaces.[4] Cell adhesion and aggregation is well documented for gut-associated lactobacilli as is their protective role against digestive enzymes and acids.[3] These surface proteins give the cell a hydrophobic character and play a role in specific interactions with intestinal epithelium cells and with other bacteria.[4] Surface layer associated with moonlighting proteins could act as adherence factors.[3] *Lb. helveticus* T159 has the high capability of adhesion, auto and coaggregation.[4] This protein used to detected in *Lb. helveticus* strain.

The addition of lactobacilli as an adjunct to the normal starter has been studied by many researchers to increase casein hydrolysis and enhance flavour development during cheese ripening.[7] Fenelon et al.[6] demonstrated that *Lb. helveticus* strains produce novel flavors and improve the acceptability of reduced fat Cheddar cheese over that of the control cheeses containing only mesophilic starter lactococci in low fat cheeses. This study indicated that the use of *Lb. helveticus* adjuncts may be important in the manufacture of low-fat cheeseswith more acceptable flavor to consumers. The structure of low-fat cheese varied when used *Lb. Helveticus* (Figure 1).

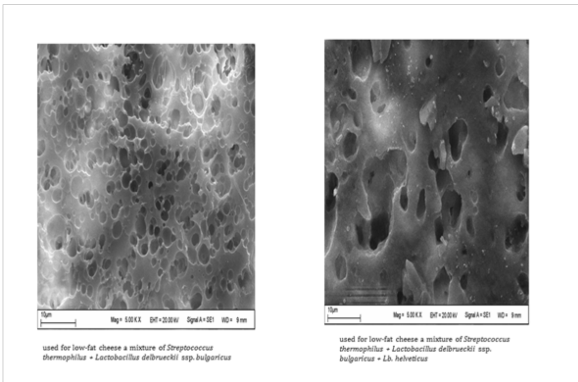

Figure 1 The structure of low-fat cheese varied when used *Lb. helveticus*.

Use for milk products

Autolysis is the spontaneous disintegration of bacterial cells which results in the liberation of the cytoplasmic content of the cell, including the intracellular enzymes.[5] Release of intracellular enzymes is considered to be highly important during cheese ripening as they play a key role in textural changes and flavour development.[7] The strain *Lb. helveticus* DPC4571 has emerged as a promising flavor adjunct culture for Cheddar cheese given that it is consistently associated with improved flavor,[5] but autolysis was not enhanced flavor development without high lipolytic and proteolytic activity.[7]

Bacterial autolysis results from the enzymatic degradation of the cell wall peptidoglycan by endogenous peptidoglycan hydrolases named autolysins and it occured within and without the cell.[8] It also convert milk peptides and fats into desirable flavor compounds.[7] After the initial breakdown of caseins by rennet, milk endogenous proteases and bacterial cell wall protease, a set of peptidases is able to degrade the resulting peptides into free amino acids.[8] *Lb. helveticus* DPC4571 is one of the highly autolytic strain and its genome sequence revealed the presence of 8putative lysin genes including autolysin amidases, enterolysins,and n-acetylmuramidases.[5]

Bacteriophage infections represent a serious problem in dairy fermentative processes, Culture rotation programs and direct to vatinoculation of starters are longstanding practices to control phage infections in industrial fermentation, whereas similar approaches cannot be applied to undefined cultures. Although it is believed that the richness and heterogeneity of the microbial composition may represent a natural barrier against phage infection problems, phage contamination of undefined starter cultures frequently occurs because they are propagated under non-aseptic conditions, without any control measures.[9] *Lb. helveticus* phages have been isolatedfrom natural whey starters.[10] The presence of active lytic phages attacking *Lb. helveticus* strains in natural whey starters used for production of long-ripened cheeses.[11] LAB produced from bacteriocins which used in fermentation and meat and milk preservation for along time.[12] They are of interest because of their inhibitory activity against food spoilage and food-borne pathogenic bacteria.[5] The main targets of LAB bacteriocins are the cell membrane andcell wall but they can work through many mechanisms to exert an antimicrobial effect.[13] *Lb. helveticus* 481 produces a class III bacteriocin known as helveticin J, which inhibits growthof *Lactobacillus* species.[5]

Angiotensin-converting enzyme (ACE) inhibition leads to a decrease in the level of the vasoconstricting peptide, angiotensin II, and a corresponding increase in the level of the vasodilatory peptide, bradykinin, therefore yielding an overall reduction in blood pressure.[14] Peptides with angiotensin converting enzyme inhibitors (ACE-I) activity have already been isolated from different food proteins.[15] Fermented with *Lb. helveticus* has source of ACE-I peptides.[16] An alternative process has been developed to produce cultured butter without the formationof sour buttermilk. In this process lactose-reduced whey inoculated with *Lb.helveticus* and skim milk inoculated with a starter culture to produce aroma compoundsand lactic acid are added to the pasteurized cream. The cream is further churned andworked. The resulting butter is known as sour aromatic butter. Sweet buttermilk is notas high in acidity as sour buttermilk.[17]

Health benefit

Lb. helveticus has a suite of peptides and proteinases that can degrade milk proteinto discrete peptides. For this reason, *Lb. helveticus* inparticular is very effective in the production of bioactivepeptides that have possible therapeutic values from milk. Elfahri et al.[18] studied for four highly proteolytic strains of *Lb. helveticus* ability to release antioxidative and anti-colon cancer compounds from skim milk during fermentation for up to 24h at 37°C. *Lb. helveticus* 474 showed the highest free radicalscavenging activity at 12h of fermentation. Arterial stiffening is markedly accelerated in hypertension and it is an independent predictor of coronary heart disease in essential hypertension. Jauhiainen et al.[19] evaluated the 10-week-treatment effect of *Lb. helveticus* fermented milk containing the tripeptides isoleucyl-prolyl-proline and valyl-prolyl-proline on ambulatory arterial stiffness index. The ambulatory arterial stiffness index improved significantly in the peptide milk group but not in the placebo group.

Conclusion

The cheeses containing *Lb. helveticus* accelerated ripening and enhanced flavour. They have high level of lysis. *Lb. helveticus* adjunct cultures not only used for flavour development in cheeses but also they have potential to produce bioactive compounds with antioxidative and anti-cancerogenic activities.

Acknowledgements

There is no acknowledgement.

Conflict of ınterest

The author declares no conflict of interest.

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DOI: 10.15406/mojfpt.2017.04.00113

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Citation: Oluk AC, Lactobacillus helveticus-a brief overview of thermophilic lactic acid bacteria. *MOJ Food Process Technol.* 2017;4(6):198–200.
DOI: 10.15406/mojfpt.2017.04.00113