

4 PROTECTION

Special Protective Food Cultures



4PROTECTION,
THE NATURAL GUARD FOR
YOUR PRODUCT IDENTITY

INTRODUCTION

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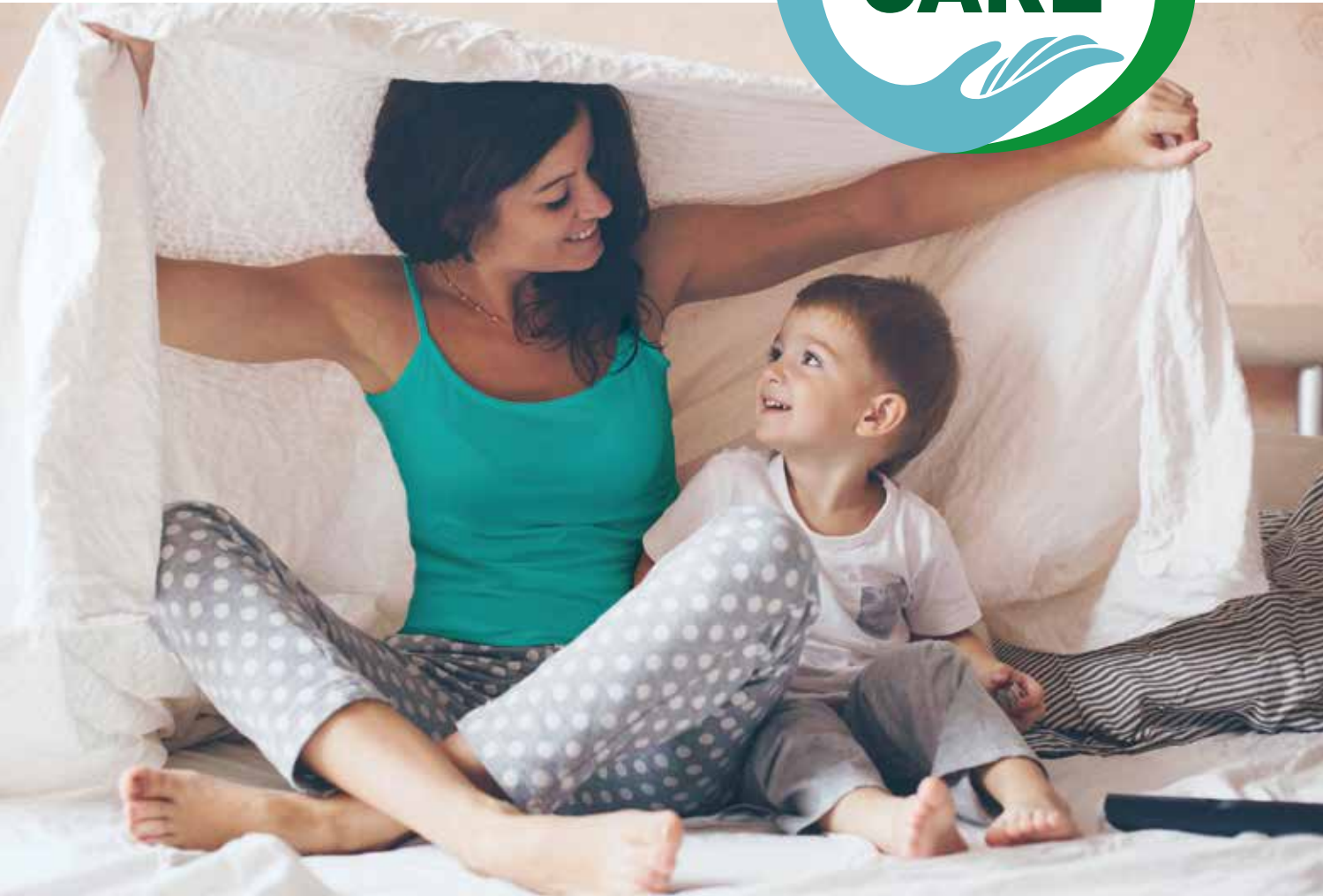
AYM – Anti Yeast and Moulds

AL – Anti *Listeria monocytogenes*

AC – Anti Clostridia

AOSM – Anti Other Spoilage Microorganisms

ABOUT SACCO



INTRODUCTION

No additives, no preservatives, 100% natural are the most prevalent trends that also guide the choices of consumers; safety and durability and high quality standard level of foods is as important as ever. Sacco has the right ingredients for the success of your products and the satisfaction of your customers.

4Protection Special Cultures help to enhance the quality and protect your brand image, allow the product to get to the end of shelf life ensuring a structural and sensorial stability, help to maintain freshness and do not change the taste, aroma and texture. Your ally for a much more genuine product till the consumer table.





4Protection Special Food Cultures add an extra hurdle to prevent the growth of unwanted microorganisms, protecting the quality and food safety and help reduce food waste.



WHAT IS 4PROTECTION LINE AND WHY USE IT

Sacco has selected microorganisms for protection against spoiling unwanted microorganisms in dairy products such as yogurt, fermented milk, fresh and semi-hard cheese, as well as in meat and fish products. The cultures of **4Protection Line** help to control and preserve the final product from alterations, fighting in a completely natural way any possible unwanted microorganisms and thereby maintaining a “clean label” product.



HOW 4PROTECTION LINE WORKS

4Protection Special Protective Food Cultures have a multiple biological interaction with the food matrix and in some cases the wild biota in the food.

In regards to the protective effect, three main mechanisms are involved:

- taking the physical space;
- fighting for nutrients;
- producing of inhibitory molecules, such as metabolites e.g., bacteriocins organic acids, peptides.

The different applications are studied as a function of the characteristics of the technological process and of the desired performance of the products.

Sacco's technologists are committed to working alongside our customers to find the best solutions and production process, working together with clients offering a product and a customized service.

4Protection line is compatible and complementary to all Sacco's starter cultures, they are used by direct inoculation or surface treatment.

Sacco is glad to help customers in finding the best solutions for their specific purpose, according to the characteristics of the products, the technological process and the activity needed from the use of our protective cultures.



4PROTECTION LINE FOR DAIRY PRODUCTS

Sacco has 4 lines of products dedicated to the protection of dairy products:

Anti Yeasts and Moulds

AYM

Anti *Listeria monocytogenes*

AL

Anti Clostridia

AC

Anti Other Spoilage Microorganisms

AOSM

The 4Protection Special Food Cultures Line helps to improve the products quality and the brand image, reducing non-compliant products, business costs and therefore food waste.



AYM – Anti yeast and moulds

4Protection AYM has been designed to fight the most common problem of dairy producers, i.e. yeast and moulds. 4Protection AYM allows products to reach the end of their shelf life, ensuring structural and sensorial stability, helps to maintain their freshness and does not change their taste, aroma and texture.

Product	Applications
LPR A	Yogurt, fresh fermented products, fresh cheese, soft cheese, semi hard cheese and hard cheese
LR B	Yogurt, fresh fermented products, fresh cheese, soft cheese, semi hard cheese and hard cheese
LR4 PD	Yogurt, fresh fermented products, fresh cheese, soft cheese, semi hard cheese and hard cheese
CLP C	Fresh cheese, soft cheese, semi hard and hard cheese



4Protection Anti Y&M efficacy on yogurt and fermented milks

LPR A, LR B and LR4 PD show a strong efficacy inhibiting the development of yeast and moulds on **yogurt and fermented milks** guaranteeing the shelf life extension without the addition of preservatives nor negatively altering the organoleptic characteristics of your products (Fig.1).

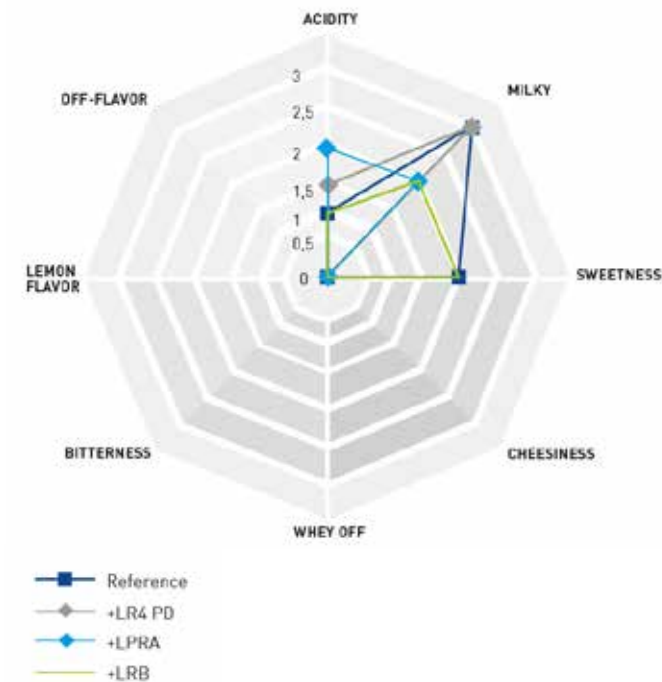


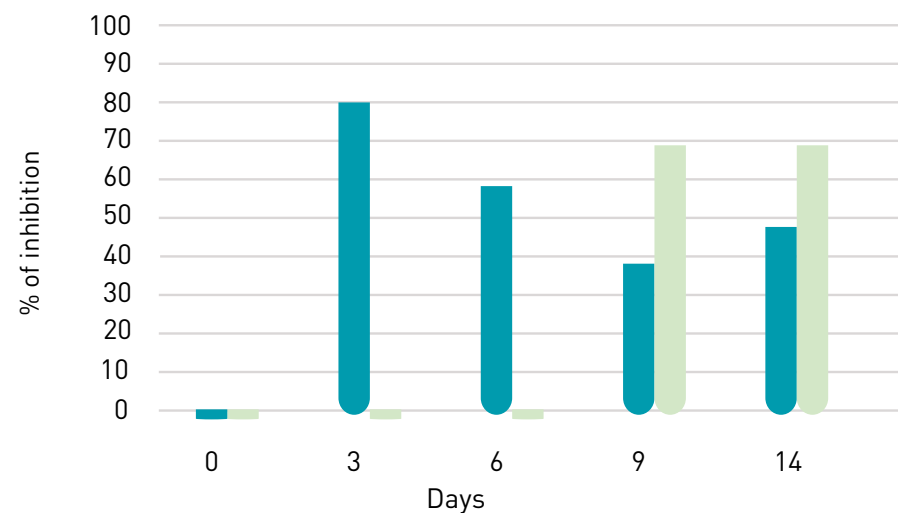
Figure 1. Sensory evaluation with 4Protection AYM cultures range



The following examples show the anti yeast (Fig. 2-3) and moulds (Fig. 4-5) activity of 4Protection Special Food Cultures Line.

4Protection Anti Yeast effect

Figure 2. Growth of spoilage yeast during storage



● LRB
● LPR A

Figure 3. Inhibition capability of AYM cultures

4Protection Anti Moulds effect

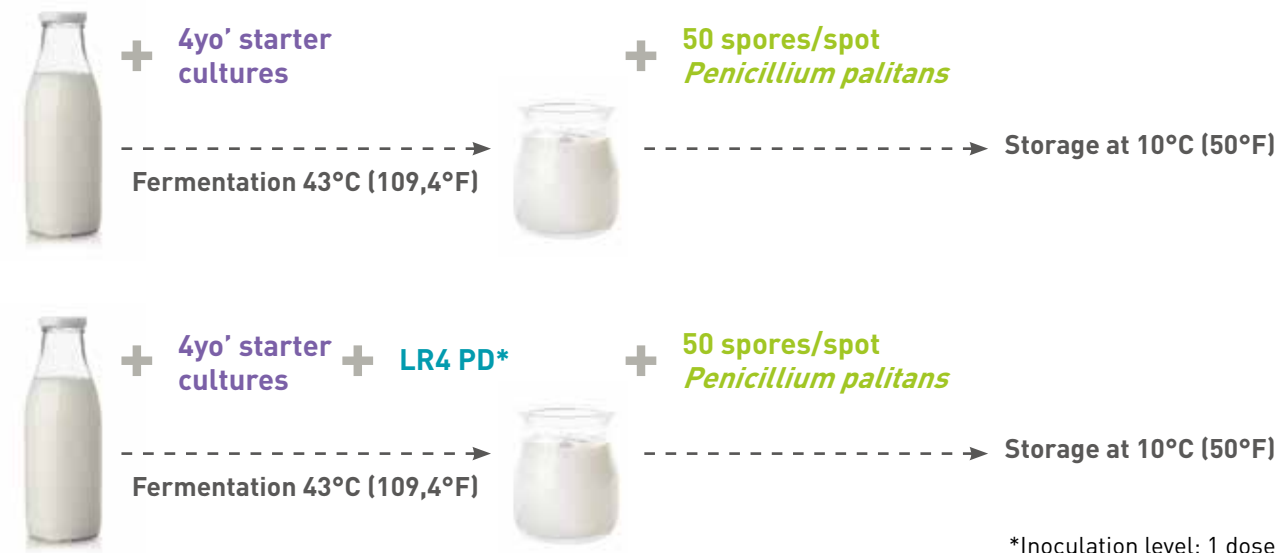


Figure 4. Protocol for anti mould activity in set yogurt

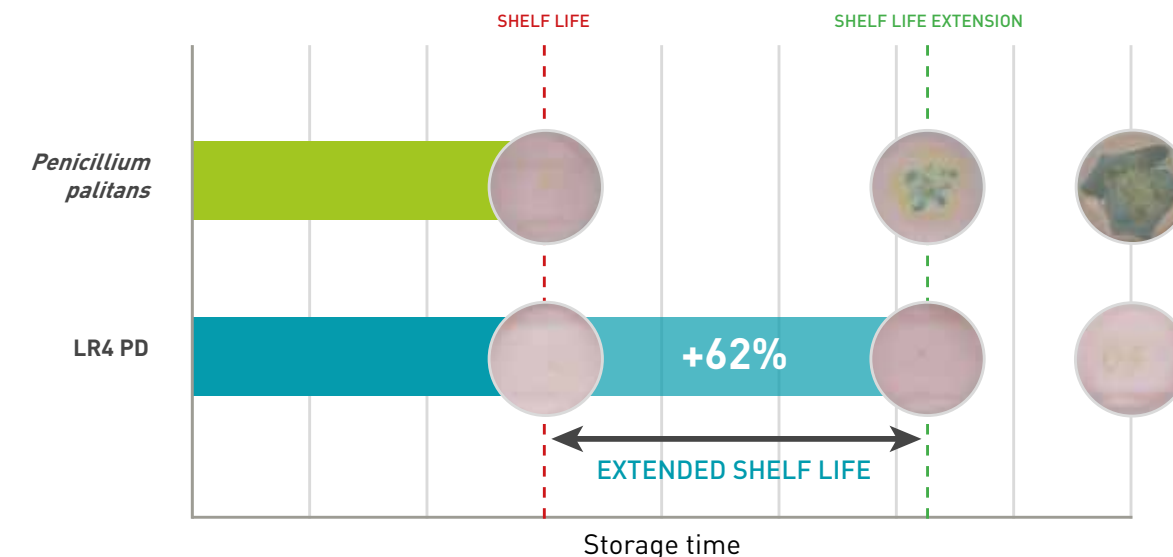


Figure 5. Shelf life extension against *Penicillium palitans*



AL – Anti *Listeria monocytogenes*

4Protection AL reduces the growth of *Listeria monocytogenes*, increasing the safety of the product throughout its shelf life.

Product **Applications**

LPAL Soft cheese

CNBAL Cheese ripened at low temperature and without sugar, like semi hard and hard cheese, gorgonzola, blue cheese

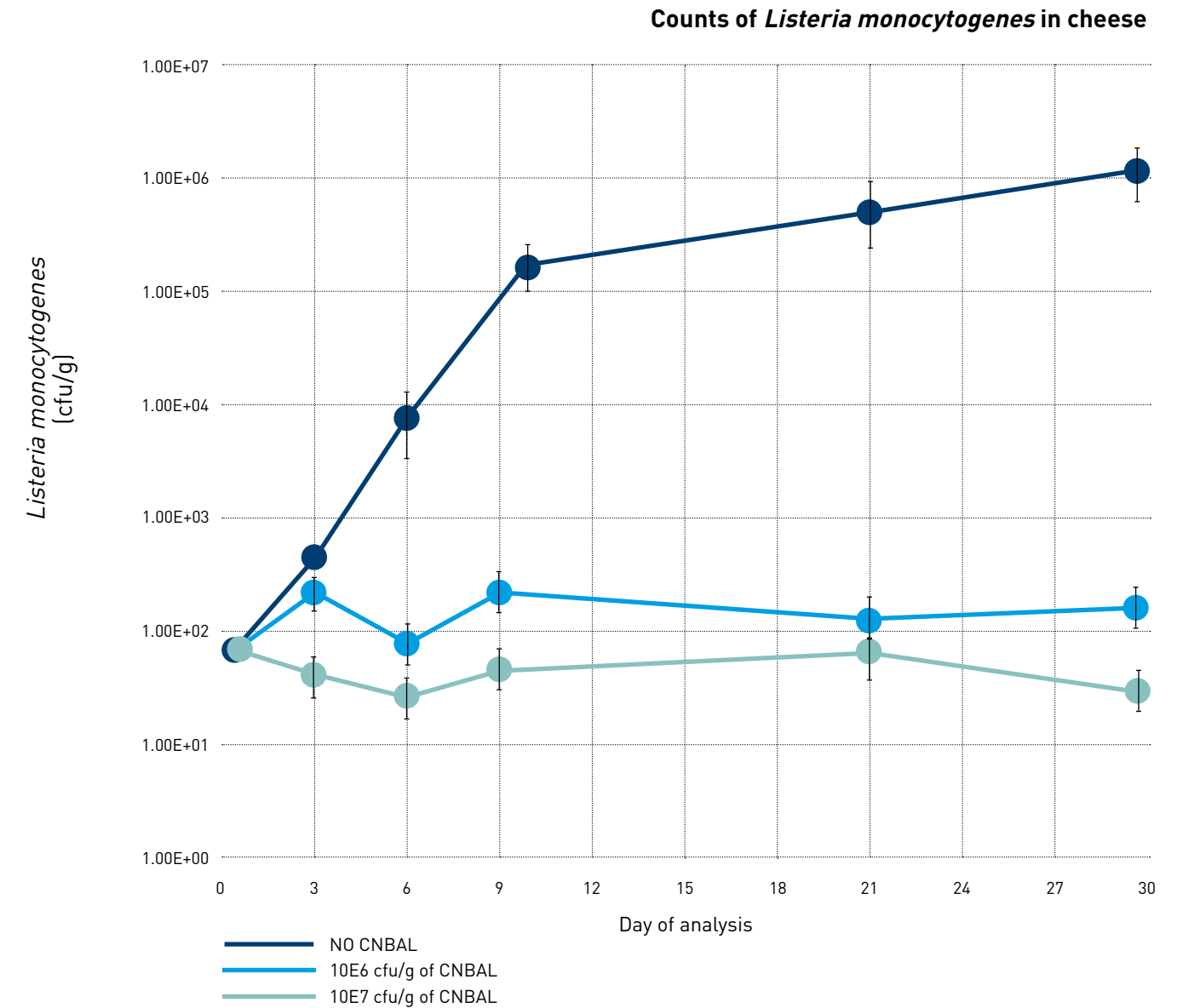


Figure 6. Counts of *Listeria monocytogenes* in cheese. Day “0” is the day of inoculation with *L. monocytogenes*. The values given are averages of duplicate sampling of three batches. Light blue line indicate low dosage of protective culture 10E6 cfu/g and light green line indicate high dosage 10E7 cfu/g. The culture CNBAL inhibits the growth of *L. monocytogenes*. The higher concentration of the culture, the better inhibition.

Log10 growth of *Listeria monocytogenes* in samples of cheese

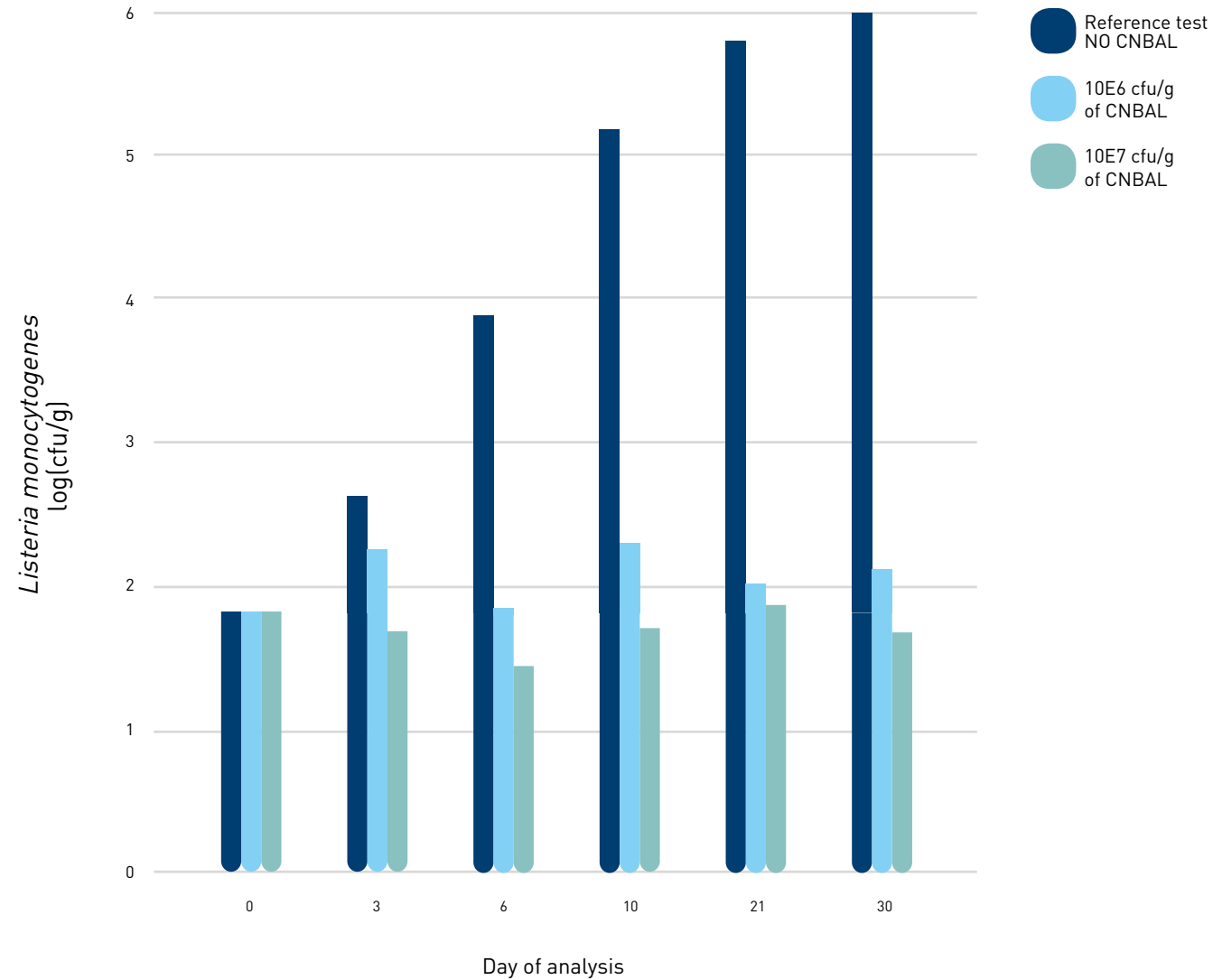


Figure.7 Counts of *Listeria monocytogenes*, given as log(cfu/g), in cheese. Day "0" is the day of inoculation with *L. monocytogenes*. The values given are averages of duplicate sampling of three batches

References:

- Testing commercial biopreservative against spoilage microorganisms in MAP packed Ricotta fresca cheese – Spanu, Scarano, Piras, Spanu, Pala, Casti, Lamon, Cossu, Ibba, Nieddu, De Santis (Food microbiology, 2017)

- Evidence on inhibition of *Listeria monocytogenes* by divercin V41 action – Richard, Brillet, Pilet, Prévost, Drider (Letters in Applied Microbiology 2003)

- Triton X-114 phase partitioning for the isolation of a pediocin-like bacteriocin from *Carnobacterium divergens* – Métivier, Boyaval, Duffes, Dousset, Compoin, Marion (Letters in Applied Microbiology 2000)

- Delineation of key amino acid side chains and peptide domains for antimicrobial properties of divercin V41, a pediocin-like bacteriocin secreted by *Carnobacterium divergens* V41 – Bhugaloo-Vial, Douliez, Mollé, Dousset, Boyaval, Marion (Applied and Environmental Microbiology, 1999)

- Enumeration of *Carnobacterium divergens* V41, *Carnobacterium piscicola* V1 and *Lactobacillus brevis* LB62 by in situ hybridization-flow cytometry – Connil, Dousset, Onno, Pilet, Breuil, Montel (Letters in Applied Microbiology 1998)

- Divercin V41, a new bacteriocin with two disulphide bonds produced by *Carnobacterium divergens* V41: primary structure and genomic organization – Métivier Pilet, Dousset, Sorokine, Angladem Zagorec, Piard, Marion, Cenatiempo, Fremaux (Microbiology 1998)

- Purification and Amino Acid Sequences of Pisciococins V1a and V1b, two class IIa Bacteriocins Secreted by *Carnobacterium piscicola* V1 that display significantly different levels of specific inhibitory activity – Bhugaloo-Vial, Dousset, Metivier, Sorokine, Anglade, Boyaval, Marion (Applied and Environmental Microbiology, 1996)



Figure 8. Evidence of bacteriocine production - (Halo size)

For a better understanding of the articles, the strains V41 and SF668 are present in CNBAL product

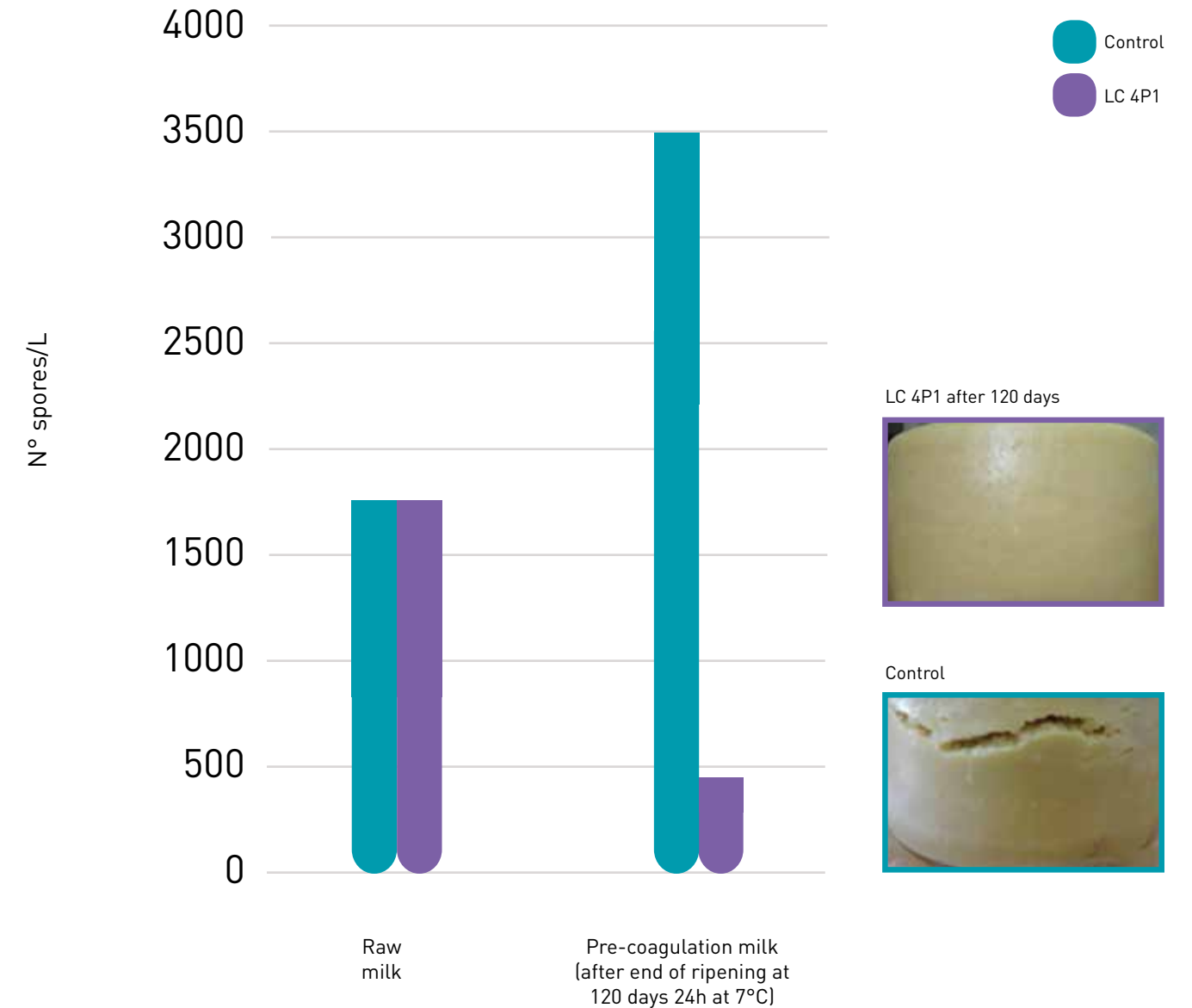
AC – Anti Clostridia

4Protection AC acts on Clostridia avoiding the late blowing, the altered aroma, unpleasant smell and ensuring a more consistent and elastic texture and thus a finished product without defects.

Product	Applications
LC 4P1	Semi soft, semi hard and hard cheese
LCP 4P2	Smear ripened cheese (typical flavour)
MO N4P01	Semi soft, semi hard and hard cheese (nisin producer)
MO N4P02	Semi soft, semi hard and hard cheese (nisin producer)
MO L4P03	Semi soft, semi hard and hard cheese (non-nisin producer)
MO L4P04	Semi soft, semi hard and hard cheese (non-nisin producer)
DY 4P13	Semi soft and semi hard cheese



Clostridia control in semi-hard production using LC 4P1



Comparison with lysozyme

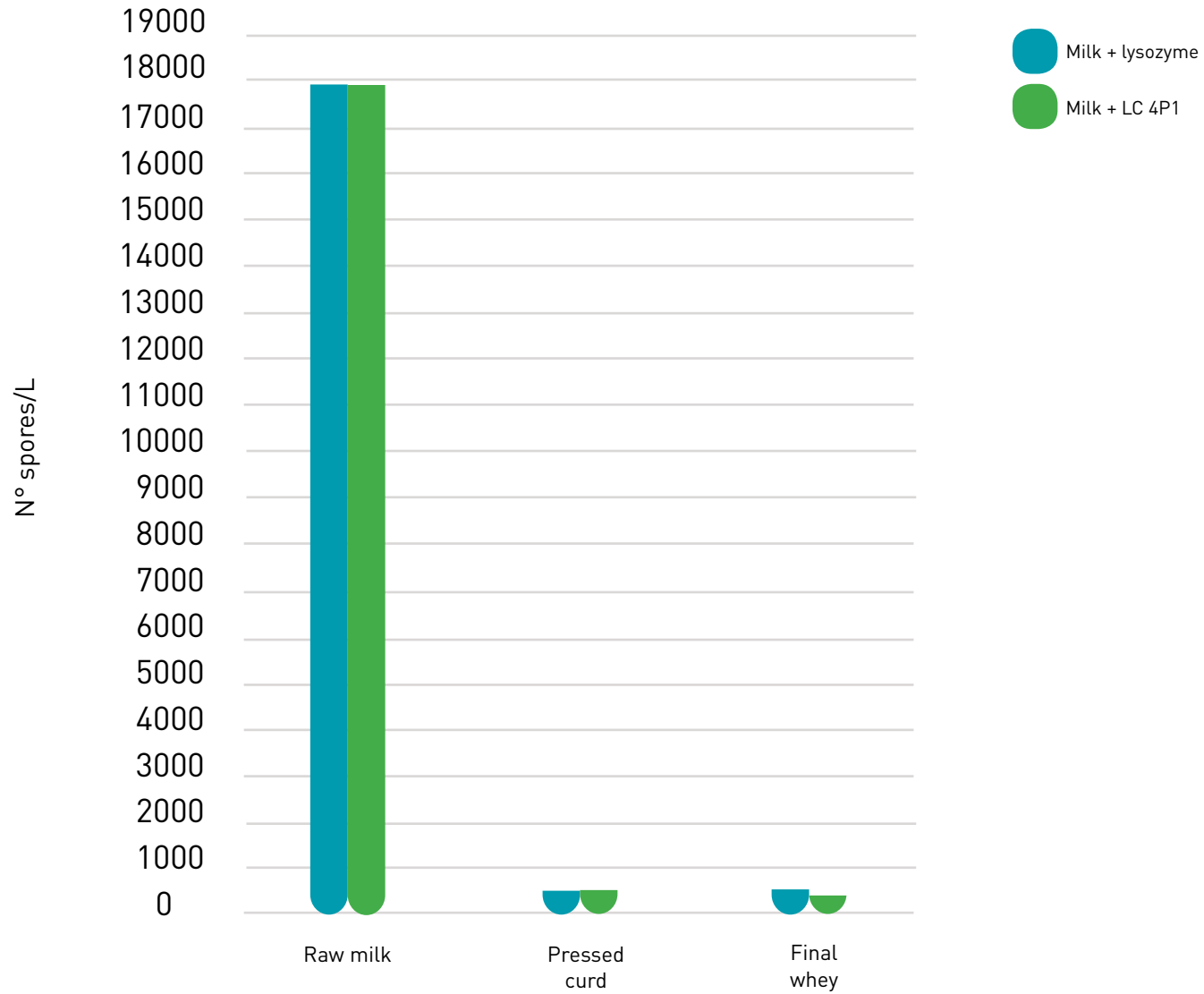


Figure.10 Count of spores of *Clostridium tyrobutyricum* in raw milk, pressed curd and final whey with lysozyme (blue histogram) and LC 4P1 (green histogram)

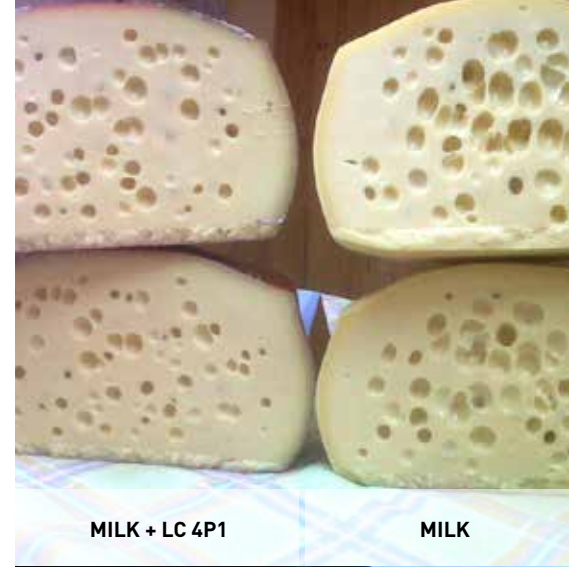


Figure 11. Test result with AC on left and control on right

References:

- Potential of anticlostridial *Lactobacillus* isolated from cheese to prevent blowing defects in semihard cheese – Christiansen, Vogensen, Nielsen, Ardö (International journal of dairy Technology 2010).
- Anticlostridial activity of *Lactobacillus* isolated from semi-hard cheeses – Christiansen, M.H. Petersen, Kosk, Møller, M. Petersen, Nielsen, Vogensen, Ardö (International dairy journal 2005)



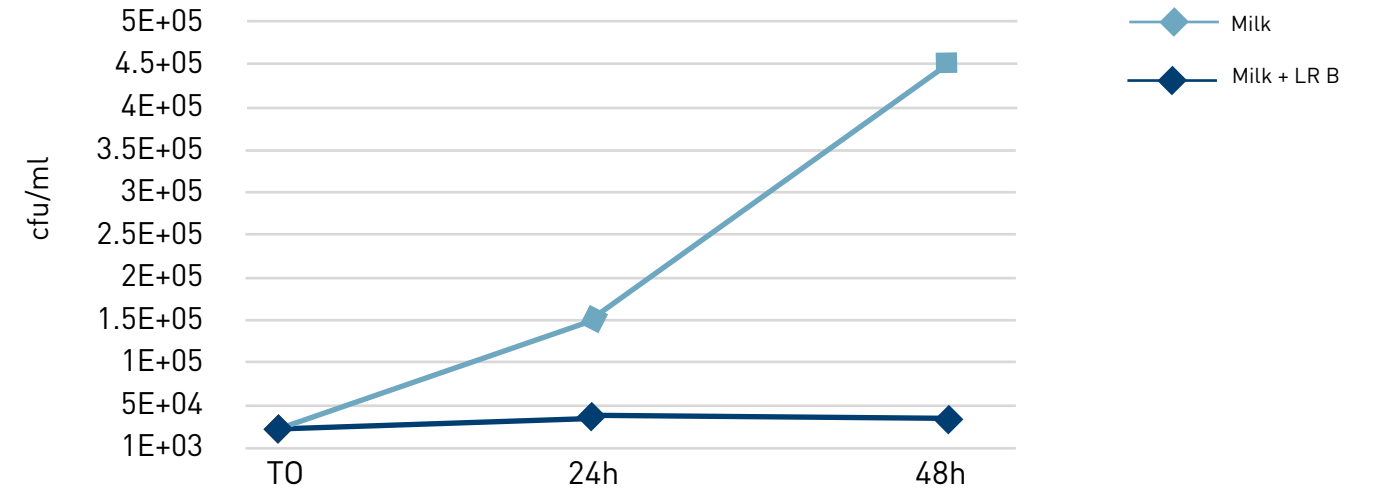


AOSM – Anti Other Spoilage Microorganisms

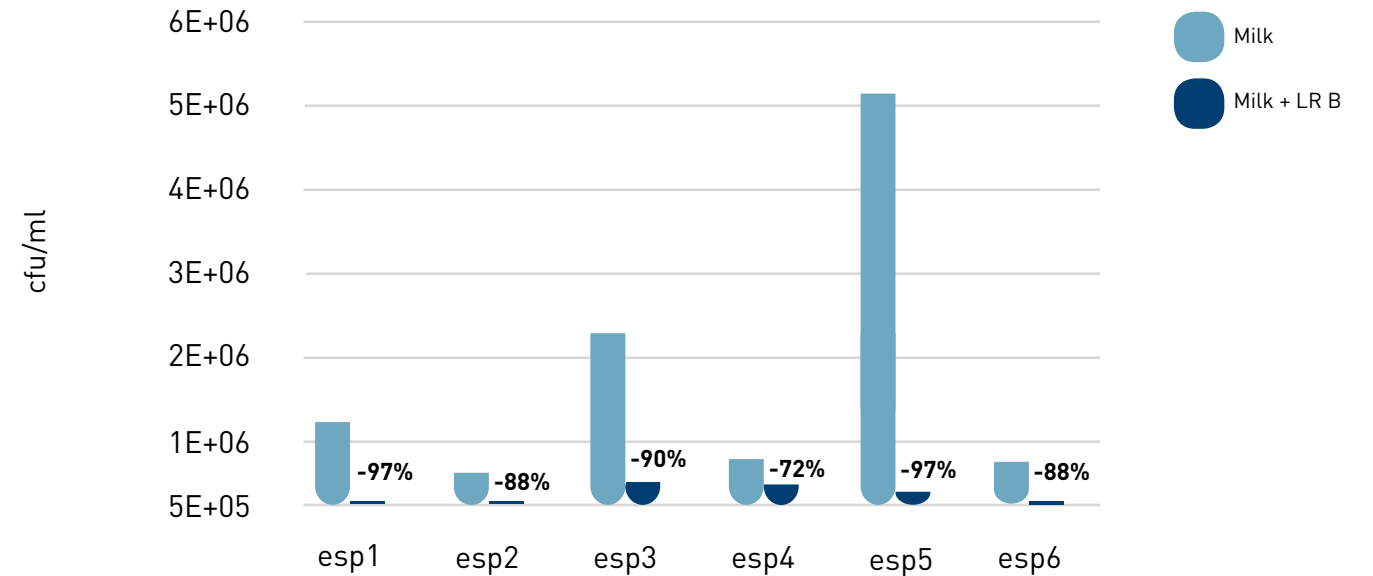
4Protection AOSM reduces the growth of unwanted indigenous microorganism present in milk or coming from the environment, thus improving the milk storage stability and quality, allowing for a standardization of the production process, in terms of acidification, yield and overall sensory.

Product	Applications
LR B	Raw or pasteurized milk

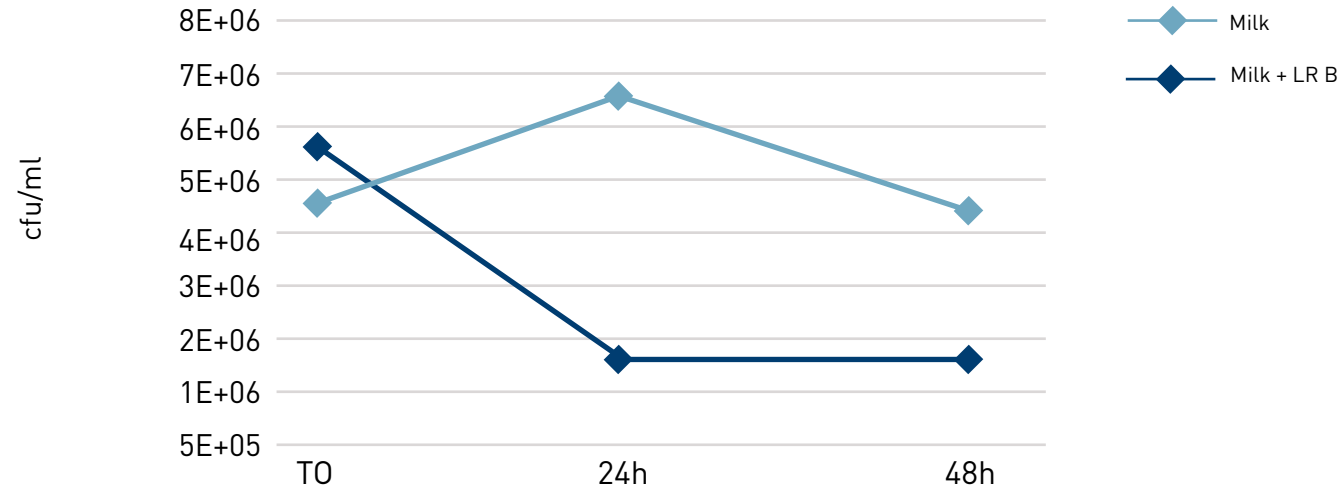
Psychrotrophic bacterial growth during milk storage



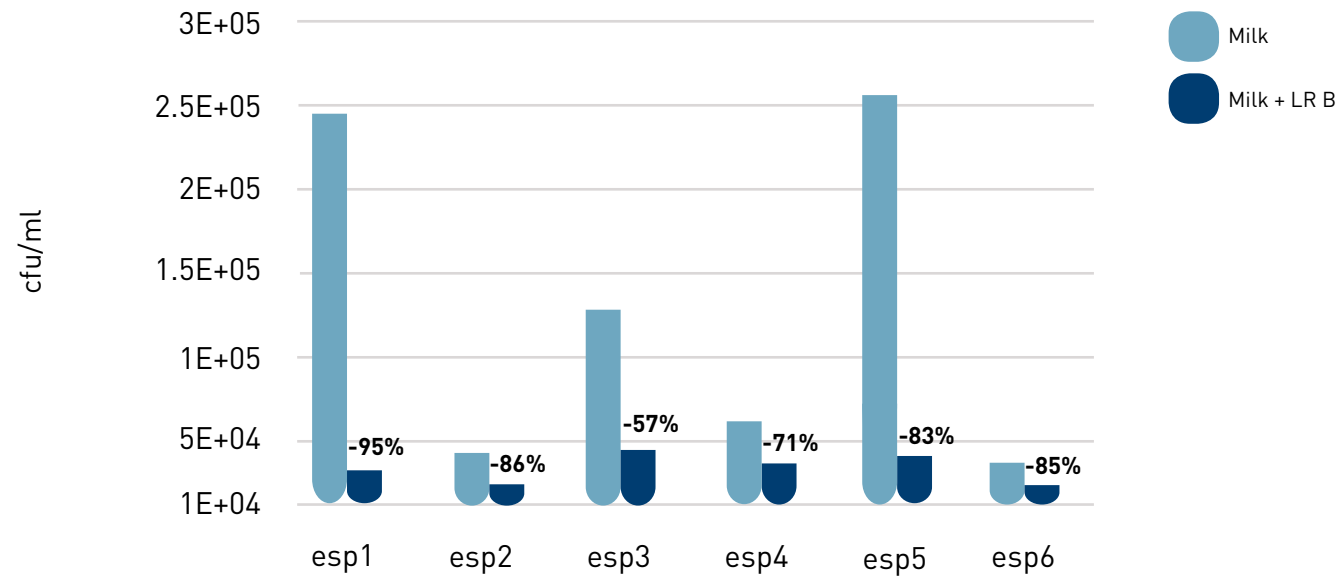
LR B effect on psychrotrophic bacteria during milk maturation (48h)



Mesophilic growth during milk storage



LR B effect on mesophilic bacteria during milk maturation (48h)



Acidification time

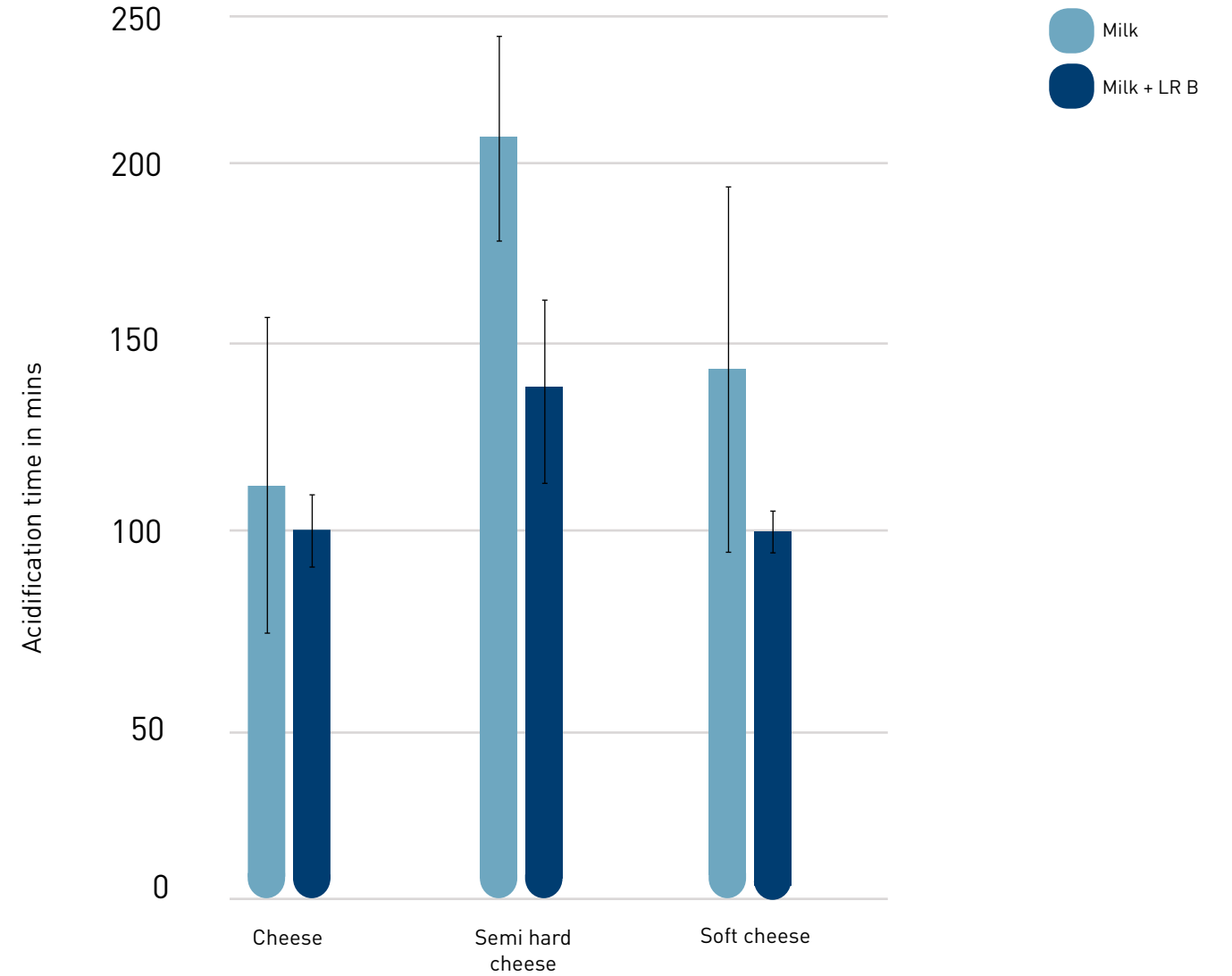
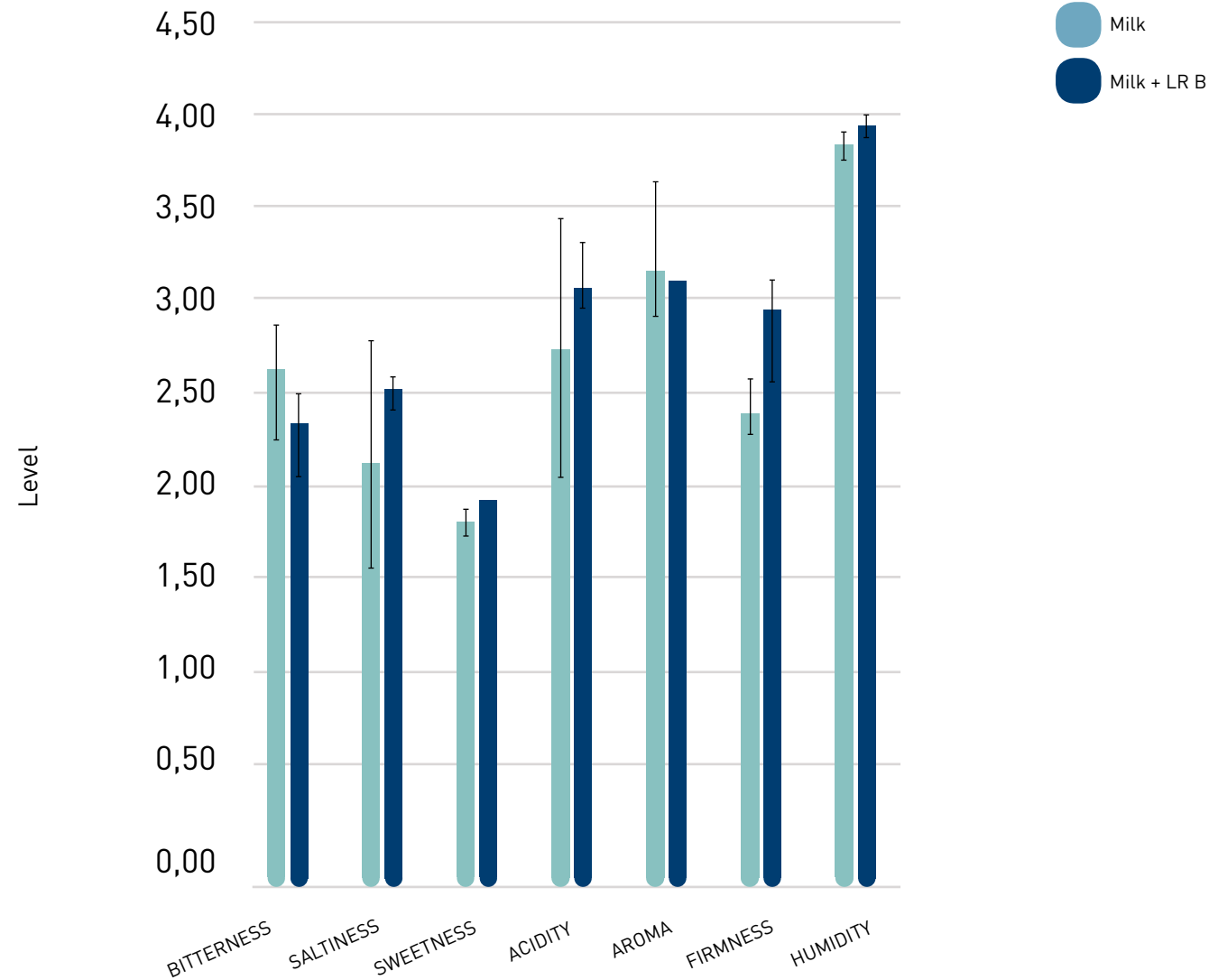


Figure 16. Acidification time is reduced with maturation of milk with LR B

Final product sensory



Effect of LR B - 4 production lots average data

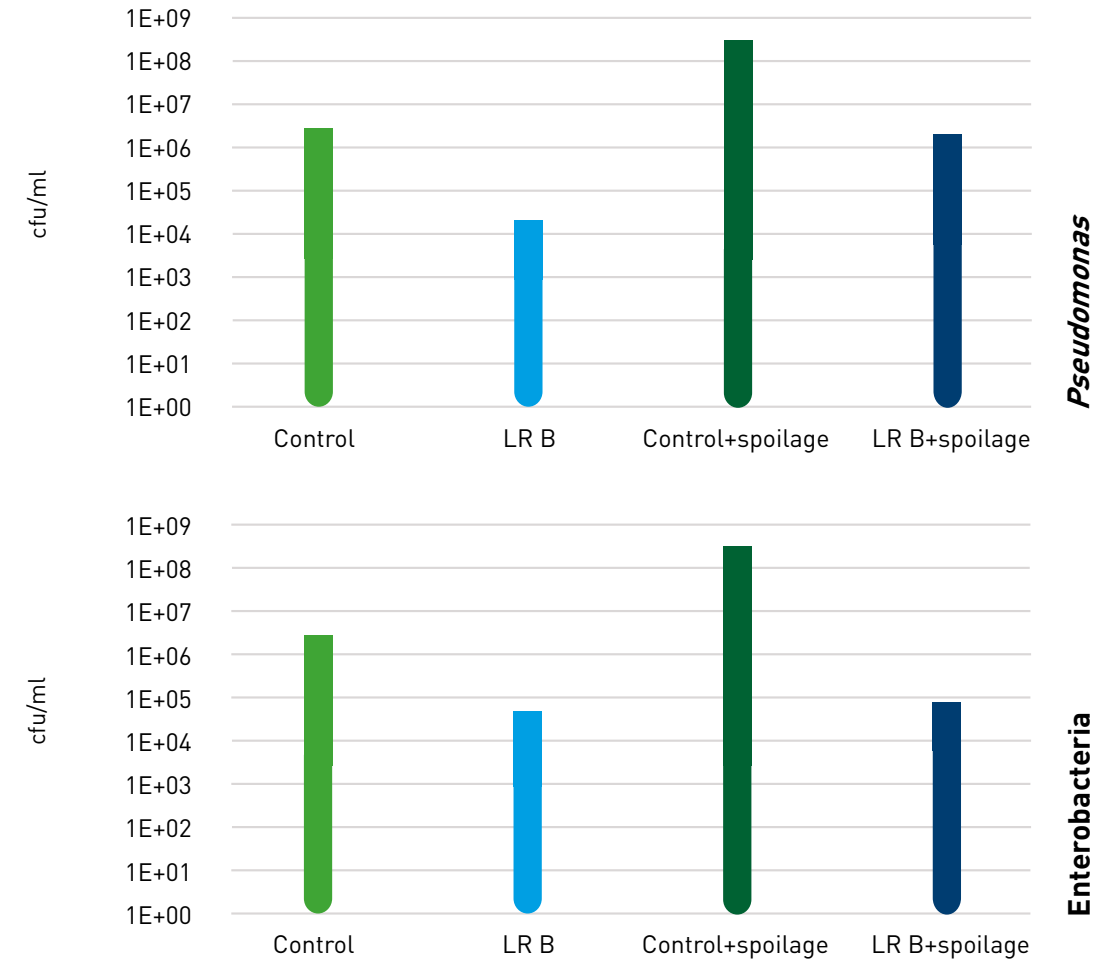


Figure 18-19. Inhibition effect of LR B in a fresh cheese. Reduction of 2-3 log of contaminant

References:

- Antimicrobial activity of *Lactobacillus rhamnosus* against *Pseudomonas fluorescens* and *Pseudomonas putida* from raw milk - D'Amico de Alcântara, Bruzaroski, Luiz, Batista de Souza, PoliDFrederico, Fagnani, Walter de Santana (Journal of Food Processing and Preservation, 2019)



ABOUT SACCO

SACCO IS AN INTERNATIONAL COMPANY WITH FAMILY SPIRIT THAT OFFERS A LARGE RANGE OF INNOVATIVE PRODUCTS.

This includes starter cultures for food fermentation (in particular dairy) and nutritional supplements (probiotic cultures), as well as instruments for the improvement of food.

The sister company Caglificio Clerici has been an Italian leader in rennet production since 1872.

Sacco furthermore acquired the Italian culture producer CSL in 2013.

The high quality of our products, the continuous innovation, the ability to work closely with our clients, and the focus on training and developing employees, are the pillars of Sacco.

In recent years the company has further invested extensively in R&D, including brand new facilities in 2018 and 2019, and has been a “pioneer” in areas such as protective cultures.

Sacco distributes its products in all key markets (110+ countries), and has ISO 22000 and FSSC 22000 accreditation and a GMP certified plant.

Sacco is a company of **Sacco System**, the biotech network applied in food, nutraceutical and pharmaceutical industry.

Find out more about our 4Protection Special Food Cultures range and customized solutions.

Visit us at www.saccosystem.com or email us at info@saccosystem.com.

SACCO system

Supporting food culture & life

4PRO
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Special Protective Food Cultures

TRADITION, PASSION
INNOVATION