N-LIGHT™
LISTERIA MONOCYTOGENES

PREVENT.
DETECT.
ACT.

ABOUT LISTERIA MONOCYTOGENES

As a zoonotic pathogen, with its natural habitat in soil and crops, *Listeria monocytogenes* can spread between humans and animals. In 99% of all human infections, food is the vehicle of transmission. While listeriosis is quite rare, it is among the leading causes of death from foodborne illnesses, boasting a case-fatality rate between 15% and 30%.

LISTERIA MONOCYTOGENES IN THE PRODUCTION OF CHEESE

Among the diversity of cheese types available on the market, several may permit the growth of *Listeria monocytogenes*, and many more allow its survival. Risks factors include the use of raw or thermised milk, the high moisture content of soft varieties, and long maturation and ripening times. Additionally, some cheeses are deliberately pierced with needles partway through the ripening to allow air to penetrate the acidic curd and promote the growth and sporulation of desirable mold, raising the risk. Fermentation processes do not necessarily eliminate the pathogen from a raw milk ferment, and conditions typically present during the 'affinage' (maturation) may introduce additional risk from cross-contamination. Understanding the behavior and minimizing sources of *Listeria monocytogenes* from milk, equipment, and the environment is crucial in risk reduction in this complex food.

REGULATORY REQUIREMENT IN SWITZERLAND:

For ready-to-eat foods that may favor the multiplication of *Listeria monocytogenes*, the germ must be "undetectable" in 25g. For foods that do not favor the multiplication of *Listeria monocytogenes*, the limit of 100 cfg/g applies.

Hygiene Ordinance
(SR 817.024.1)

A study by Martinez-Rios and Dalgaard (2018) found that *Listeria monocytogenes* was present on average in 2.3% of 130'000 cheese samples gathered between 2005 and 2015, which was more than three times higher than results from EFSA reports.

doi:10.1016/j.foodcont.2017.07.020

A 2016 study by Dzieciol et al. found that *Listeria monocytogenes* can be transported via clothes and boots of workers, resulting in contamination of other zones of various cheese processing plants.

doi:10.1016/j.ijfoodmicro.2016.02.004

UNDER WHICH CONDITIONS DOES LISTERIA MONOCYTOGENES SURVIVE?

	Growth		
	Min. (lower growth limit)	Optimum (fastest growth)	Max. (upper growth limit)
Temperature (C°)	-1.5	30.0-37.0	45.0
pH	4.2-4.3	7.0	9.4-9.5
a_w	0.93 (0.90 with glycerol)	0.99	>0.99
Salt concentration (%)[2]	<0.5	0.7	12-16
Atmosphere	Facultative anaerobe (it can grow in the presence or absence of oxygen, e.g. in a vacuum or modified atmosphere package)		
Thermal inactivation			
$D_{65°C}$	0.2 to 2 min		
z	7.5°C (4 to 11°C)		
High pressure inactivation			
400 MPa for 10 min at 20°C ⟶ 2 $\log_{10}$ reductions in phosphate buffer (pH 7)			
400 MPa for 10 min at 20°C ⟶ 8 $\log_{10}$ reductions in citrate buffer (pH 5.6)			

Listeria monocytogenes can survive and grow under hostile environmental conditions. It is salt-tolerant and can grow or survive in brine tanks at refrigeration temperatures. Nevertheless, *Listeria monocytogenes* is a poor competitor and finds it difficult to grow where lactic fermentative cultures are present in high numbers. These antagonistic microbes not only produce acid but other antimicrobial substances that inhibit *Listeria monocytogenes*.

THREE POSSIBLE RISK AREAS IN YOUR CHEESE PRODUCTION PROCESS

1 LONG-TERM MATURATION OF CHEESE

Several studies have shown that surface mold-ripened cheese and internally veined cheeses are more susceptible to *Listeria monocytogenes* growth. This is one of the most potent risk factors for *Listeria monocytogenes* in cheese manufacture. The activity of bacteria and molds causes the breakdown of acidic curd components, allowing the pH value of the cheese to rise. If *Listeria monocytogenes* is present in or on the cheese at this stage, it may flourish. Furthermore, cheeses typically mature on open racks in cold rooms, exposed to air circulation. This facilitates cross-contamination between the environment and the cheese due to air, water condensation, and the movement of employees and tools between ripening rooms and other parts of the plant.

2 USE OF RAW MILK IN CHEESE PRODUCTION

Pasteurization can be a critical point in the cheese-making process which destroys pathogenic microorganisms in the raw milk from contaminating the finished product. In cheese made from raw milk cheese, *Listeria* will not be killed by heating. Even in 'heat-treated' (thermised) milk, if *Listeria monocytogenes* is present in sufficiently large numbers, it may survive. There are economic incentives to accelerate or shorten the expensive cheese ripening process. Accelerating maturation means the inactivation of pathogens such as *Listeria monocytogenes* may be further reduced. These dangers are especially prevalent in the production of soft cheeses, which are often made from raw milk and fermentation-based solely on the natural lactic flora.

3 POST-MATURATION HANDLING OF CHEESE

After maturation, cheeses often undergo slicing, dicing, grating, and packaging. This presents further opportunities for cross-contamination: *Listeria monocytogenes* may be transferred from the cheese wires, knives, wooden boards, or the conveyor belts onto cheese or between cheeses. *Listeria monocytogenes* may be present in fatty biofilms on the surfaces of processing equipment and form a contamination reservoir as biofilms are difficult to remove. In the grating process, starch may be added to facilitate smooth flow, but if starch becomes wet, it may allow growth of the pathogen. This is a risk inherent to the industrialized cheese production chain and is therefore applicable to these types of cheese, regardless of the maturation period or process.

> **"Without the N-Light™ test, I could not sell my raw milk soft cheese. The cost and risk would be too high, and I would not be flexible enough. With our new adaptive system, we can assure product safety and quality."**

Christoph Glauser, Co-Partner Eyweid AG

Coming soon: N-Light™ *Salmonella spp.* and N-Light™ *Listeria spp.*

NEMIS TECHNOLOGIES

EMPOWERING YOU TO FIGHT THE INVISIBLE

nemistech.com