



BTSF ACADEMY

Organisation and implementation of training activities to strengthen understanding, implementation and enforcement of EU law in the area of Sanitary and Phytosanitary (SPS) standards in EU Member States and neighbouring non-EU countries

STM - Microbiological shelf-life studies of ready-to-eat foods related to *Listeria monocytogenes*

Tutors: Annie Beaufort; Hélène Bergis, Mariem Ellouze, Rubén Barcia-Cruz.

Vilnius, Lithuania. Session 1: 14-17/04/2026; Session 2: 05-08/05/2026

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2. *Listeria monocytogenes* and ready-to-eat (RTE) food

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STM - Microbiological shelf-life studies of ready-to-eat foods related to *L.monocytogenes*

Rubén Barcia-Cruz, Anses (EURL *Lm*)

Vilnius, Lithuania Session 1 14-17/04/2026; Session 2 05-08/05/26

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Presentation overview

- What is *L. monocytogenes*?
- Symptoms and foods likely to be contaminated
- Growth conditions
- Impact of intrinsic and extrinsic characteristics of food
- Listeriosis in the EU and Lithuania

BTSF What is *Listeria monocytogenes*?

- Pathogenic gram-positive, non spore-forming facultative anaerobic bacterium
- Widely distributed in the environment (e.g., soil, vegetation, silage, sewage, water, and faeces of healthy animals and humans)
- Frequently present in foods of animal and plant origin and can become endemic in food processing environments
- Can be present in cooked foods as a result of post-process contamination or inadequate heat treatment
- Causes a group of diseases which are collectively known as listeriosis
- Food contaminated with *L. monocytogenes* is main source of infection

BTSF Why is *L. monocytogenes* of concern?

- Its ubiquitous nature
- Its ability to survive and grow at refrigeration temperatures (i.e. $\leq 5^{\circ}\text{C}$)
- The severity of the disease
- The high case fatality rate

Vulnerable groups are at higher risk of hospitalisation and fatality

Older adults
(> 65 years old)

Pregnant women

Unborn and newly
delivered infants

People with diabetes

Patients undergoing
immunosuppressive or
cytotoxic treatment

Cancer patients

BTSF Symptoms and foods likely to be contaminated

Non-invasive:

Mild flu-like symptoms, myalgia (muscle pain), gastrointestinal symptoms such as nausea, vomiting and diarrhoea

Invasive:

Mild fever (with or without slight gastroenteritis or flu like symptoms), myalgia, meningitis, septicaemia, high mortality rate (20-30%)

Symptoms appear between 3 and 70 days after infection

Muscle aches, neck stiffness and severe headache

Pregnant women at risk of premature labour, meningitis in the newborn and miscarriage



Smoked salmon



Deli meats and pâtés



Fermented meats



Soft or semi soft cheese



Coleslaw



Raw drinking milk



Sandwiches



Salads



RTE dips and spreads



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Growth conditions

Table 1. Growth /survival characteristics of *Lm* (strain-specific) in broth medium

Factor ^{a,b}	Can grow			Survival (but not growth) ^d
	Min. (lower growth limit)	Growth Optimum ^c (fastest growth)	Max. (upper growth limit)	
Temperature (°C)	-2	30 - 37	45	-18
pH ^e	4.0 - 4.3	7.0	9.6	3.3 - 4.2
a _w	0.92 (0.90 with glycerol)	0.99	/	<0.90
Salt (NaCl) content ^f	/	/	12	≥20
Gas atmosphere	Facultative anaerobic and microaerophilic (able to grow in presence/absence of O ₂) (e.g. under vacuum or modified gas atmosphere)			
Heat treatment during food processing	A temperature/time combination e.g. of 70°C x 2 min is required for a D-6 (i.e. 10 ⁶ or 6 decimal) reduction in numbers of <i>Lm</i> cells. Other temperature/time combinations may also provide the same reduction.			

Source: [Guidance document on *Listeria monocytogenes* monitoring and shelf-life studies for ready-to-eat foods \(European Commission, 2025\)](#)

^a The limits for growth and survival of *Lm* presented in this table are based on research carried out primarily in laboratory media under optimum conditions and should only be used as estimates for the impact in foods.

^b Note that these numbers are set based on different models and practical approaches. See section 6.4.

^c Optimum indicates when the growth of *Lm* is fastest.

^d Survival period will vary depending on nature of food and other factors.

^e Inhibition of *Lm* is dependent on type of acid present.

^f Based on percent NaCl, water phase.

BTSF Growth conditions

- *L. monocytogenes* resist strong environmental stresses (such as heavy metal ions, high salt concentrations, low pH-values, low temperatures and low water activity)
- Form communities of bacteria called biofilms which decrease susceptibility to disinfectants and environmental stress
- Can survive in niche harbourage points in food processing environment
- Post-process contamination of RTE food can occur
- Implementation of HACCP principles together with good hygiene practice essential for control

Intrinsic characteristics	Extrinsic characteristics
pH (Acidity)	Good manufacturing and hygiene practices (Food Safety Management System)
Water activity (a_w)	Storage temperature
Preservatives (e.g., Nitrate)	Gas atmosphere and type of packaging
Background Microflora (e.g., lactic acid bacteria in fermented food)	Food processing (e.g., heat treatment, chilling, freezing)

Foods most often associated with human listeriosis include those which:

- Support the growth of *L. monocytogenes* (i.e., fall under food category 1.2 in Commission Regulation 2073/2005, footnote 8 - pH ≥ 5.1 ; $a_w \geq 0.95$; combined pH ≥ 4.5 and $a_w \geq 0.93$)
- Have a long shelf-life duration under refrigeration
- *L. monocytogenes* can grow to significant numbers in food held at refrigeration temperatures when given sufficient time
- Are consumed without further treatments which would kill *L. monocytogenes*, (e.g., cooking)
- Consumer behaviour and new trends? (e.g., eating non-RTE frozen vegetables without cooking first)

BTSF Listeriosis in EU

- In 2024 listeriosis was the fourth most reported zoonosis in the EU
- The EU notification rate was 0.69 per 100,000 population
- The overall EU trend for listeriosis in the period 2020–2024 showed a significant increase
- The overall EU case fatality rate was high (15.6%)
- *L. monocytogenes* infections were most commonly reported in the age group over 65 years of age (81.7%)
- Listeriosis was the most severe disease in 2024, showing the highest case fatality and hospitalisation rates among reported cases
- Listeriosis accounted for the highest number of deaths (N=301)

Source: EFSA and ECDC (European Food Safety Authority and European Centre for Disease Prevention and Control), (2025). The European Union One Health 2024 Zoonoses Report. EFSA Journal, 23(12), e9759. <https://doi.org/10.2903/j.efsa.2025.9759>

BTSF Listeriosis in EU

Human cases [EU, 2024]

Notification rate
(per 100,000 population)

0.69

Trend
(2020-2024)



↑ Increasing
↓ Decreasing
— Stable

■ 3041 Cases of illness

■ 2062 Infections acquired in the EU

■ 14 Infections acquired outside the EU

■ 965 Unknown travel status or unknown country of infection

■ 1715 Hospitalisations (97.3%)*

■ 301 Deaths (15.6%)*

* The percentages are calculated on the number of cases with information available (for further details see Table 2)

■ ECDC data

Source: EFSA and ECDC (European Food Safety Authority and European Centre for Disease Prevention and Control), (2025). The European Union One Health 2024 Zoonoses Report. EFSA Journal, 23(12), e9759. <https://doi.org/10.2903/j.efsa.2025.9759>

BTSF Listeriosis in EU

Foodborne outbreaks & related cases [EU, 2024]



38 Foodborne outbreaks

14 Strong-evidence outbreaks ■

24 Weak-evidence outbreaks ■

210 Cases of illness

149 Hospitalisations (72.3%)*

17 Deaths (8.1%)*

B I S F

Source: EFSA and ECDC (European Food Safety Authority and European Centre for Disease Prevention and Control), (2025). The European Union One Health 2024 Zoonoses Report. EFSA Journal, 23(12), e9759. <https://doi.org/10.2903/j.efsa.2025.9759>

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Listeriosis in EU

Source: EFSA and ECDC (European Food Safety Authority and European Centre for Disease Prevention and Control), (2025). The European Union One Health 2024 Zoonoses Report. EFSA Journal, 23(12), e9759. <https://doi.org/10.2903/j.efsa.2025.9759>

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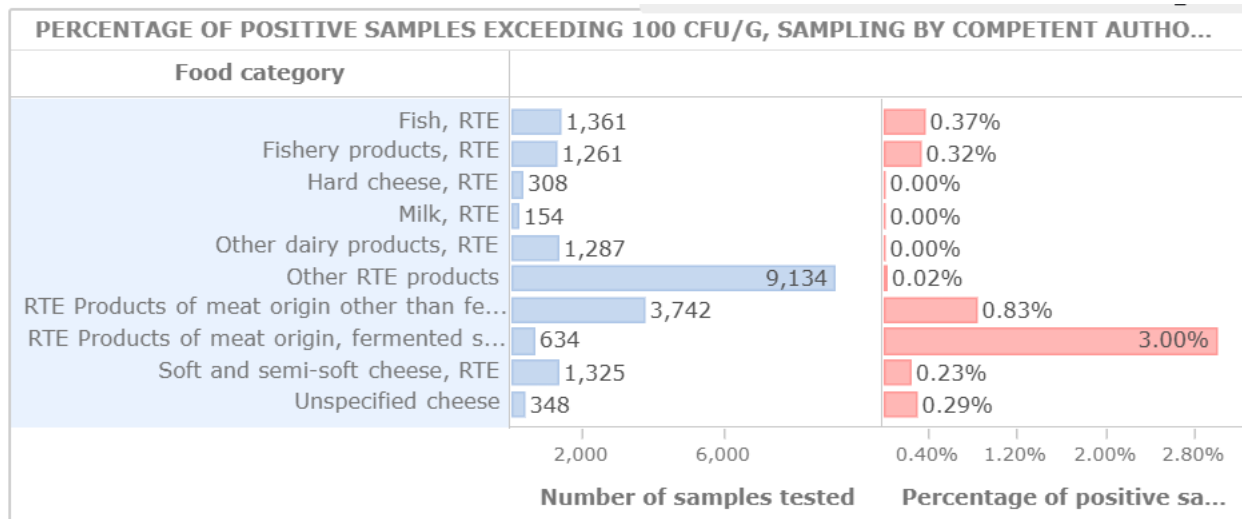
N of outbreaks		N of outbreaks per 100,000 population **		N of outbreak cases per 100,000 population		Implicated food vehicles (Strong-evidence outbreaks)	
Austria	1	AT	0.011	AT	0.044		Vegetables and juices and other products thereof 3 Outbreaks
Belgium	8	BE	0.068	BE	0.228		
Bulgaria	0	BG	0	BG	0		
Croatia	0	HR	0	HR	0		Mixed food 3 Outbreaks
Cyprus	0	CY	0	CY	0		
Czechia	1	CZ	0.009	CZ	0.092		
Denmark	6	DK	0.101	DK	0.403		Fish and fish products 3 Outbreaks
Estonia	0	EE	0	EE	0		
Finland	3	FI	0.054	FI	0.625		
France	1	FR	0.001	FR	0.038		Pig meat and products thereof 2 Outbreaks
Germany	5	DE	0.006	DE	0.013		
Greece	0	EL	0	EL	0		
Hungary	0	HU	0	HU	0		Cheese Dairy products other than cheeses Meat and meat products, unspecified 1 Outbreak (each)
Ireland	1	IE	0.019	IE	0.056		
Italy	8	IT	0.014	IT	0.095		
Latvia	0	LV	0	LV	0		
Lithuania	0	LT	0	LT	0		
Luxembourg	0	LU	0	LU	0		
Malta	0	MT	0	MT	0		
Netherlands	1	NL	0.006	NL	0.022		
Poland	1	PL	0.003	PL	0.011		
Portugal	0	PT	0	PT	0		
Romania	0	RO	0	RO	0		
Slovakia	0	SK	0	SK	0		
Slovenia	0	SI	0	SI	0		
Spain	1	ES	0.002	ES	0.004		
Sweden	1	SE	0.009	SE	0.038		
UK (N. Ireland)	0	XI	0	XI	0		

** Differences among countries shall be interpreted with caution as this indicator depends on several factors including the type of outbreaks under surveillance and does not necessarily reflect the level of food safety in each country.

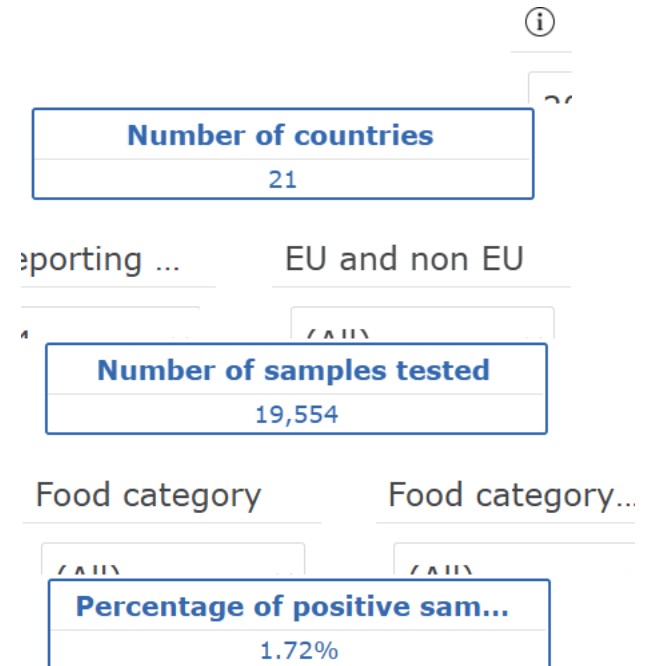
■ EFSA data

- Results varied according to the RTE food category, the sampling stage, the number of tested samples and the number of reporting countries
- Highest proportion of positive samples (from 2.3% to 14.6%) were observed for fish and fishery products, meat products from bovines or pigs and fruits, vegetables and juices.
- Distribution level: highest value was found in 'products of meat origin, fermented sausages' (6.6%). For 'fish' (2.9%), 'products of meat origin other than fermented sausages' (2.2%), 'hard cheeses' (1.6%) and 'other products' (1.6%), positive samples were relatively low.
- Manufacturing level: products of meat origin other than fermented sausages (2.5%), fish (2.4%) and cheese (2.3%)
- Primary production (*L. monocytogenes* in animals): 2.3 cattle; 3.6% small ruminants (sheep and goats); 0.05% pigs

BTSF EFSA Dashboards



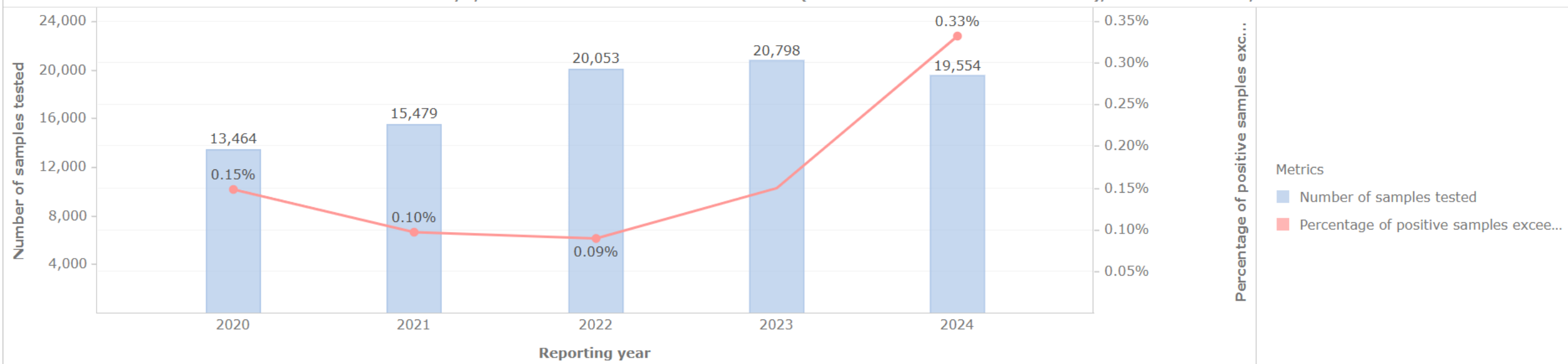
PERCENTAGE OF POSITIVE SAMPLES AND SAMPLES EXCEEDING 100 CFU/G, SAMPLING BY COMPETENT AUTHORITIES (CONTEXT OF L. MONOCYTOGENES FSC), AT DISTRIBUTION, BY FOOD CATEGORY						
Food category	N countries	N samples tested with enumeration test	N positive samples with enumeration test	% positive samples with enumeration test	N positive samples with enumeration test and exceeding 100 CFU/g	% positive samples with enumeration test and exceeding 100 CFU/g
Total	21	19,554	271	--	65	--
Fish, RTE	16	1,361	35	2.94%	5	0.37%
Fishery products, RTE	12	1,261	7	0.87%	4	0.32%
Hard cheese, RTE	6	308	5	1.62%	0	0.00%
Milk, RTE	6	154	0	0.00%	0	0.00%
Other dairy products, RTE	14	1,287	2	0.16%	0	0.00%
Other RTE products	18	9,134	146	1.62%	2	0.02%



For summary statistics on major RTE food categories see EFSA dashboard on *L. monocytogenes*: [Listeria dashboard | EFSA \(europa.eu\)](#)

BTSF EFSA Dashboards

PERCENTAGE OF POSITIVE SAMPLES EXCEEDING 100 CFU/G, SAMPLING BY COMPETENT AUTHORITIES (CONTEXT OF *L. MONOCYTOGENES* FSC), AT DISTRIBUTION, BY REPORTING YEAR



LISTERIA MONOCYTOGENES STATISTICS, IN MAJOR FOOD CATEGORIES, BY REPORTING YEAR AND REPORTING COUNTRY

Reporting country	Reporting year	2024	2023	2022	2021	2020
	Food category	N sampling units tested	N sampling units tested	N sampling units tested	N sampling units tested	N sampling units tested
Lithuania	Fish and fishery products				86	
	Meat and meat products	962	387			
	Milk and milk products	962	387	85	86	55

For summary statistics on major RTE food categories see EFSA dashboard on *L. monocytogenes*: [Listeria dashboard | EFSA \(europa.eu\)](#)

BTSF Listeriosis in Lithuania

TABLE 33 Reported confirmed human cases of invasive listeriosis and notification rates per 100,000 population in EU MS and non-MS countries, by country and year, 2020–2024.

Country	2024				2023		2022		2021		2020	
	National coverage ^a	Data format ^a	Confirmed cases and rate		Confirmed cases and rate		Confirmed cases and rate		Confirmed cases and rate		Confirmed cases and rate	
			Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate
Lithuania	Y	C	17	0.59	20	0.70	13	0.46	7	0.25	7	0.25

^aY, yes; N, no; A, aggregated data; C, case-based data.

^bSentinel system; notification rates calculated with an estimated population coverage of 80%.

^cNotification rates calculated with an estimated population coverage of 100% in 2024 and 97% in 2021–2023. No information on estimated coverage in 2020, so notification rate cannot be estimated.

Source: EFSA and ECDC (European Food Safety Authority and European Centre for Disease Prevention and Control), (2025). The European Union One Health 2024 Zoonoses Report. EFSA Journal, 23(12), e9759. <https://doi.org/10.2903/j.efsa.2025.9759>

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Thank you!

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