Chapter 15: *Listeria monocytogenes*

Updated:

Potential Food Safety Hazard

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The genus *Listeria* includes 6 different species (*L.* monocytogenes, *L. ivanovii*, *L.* innocua, *L.* welshimeri, *L.* seegligeri, and *L. grayi*). Both *L. ivanovii* and *L. monocytogenes* are pathogenic for mice, but only *L. monocytogenes* is consistently associated with human illness (Hitchins, 1998). *L. monocytogenes* is widespread in nature and has been isolated from soil, vegetation, marine sediments and water. In the early 1900s, *L. monocytogenes* was recognized as a bacterium that caused illness in farm animals. More recently, it has been identified as the cause of listeriosis in humans. Most healthy individuals are either unaffected by *L. monocytogenes* or experience only mild flu-like symptoms. Victims of severe listeriosis are usually immunocompromised. Those at highest risk include cancer patients, individuals taking drugs that affect the body' s immune system, alcoholics, pregnant women, persons with low stomach acidity and individuals with AIDS. Severe listeriosis can cause meningitis, abortions, septicemia and a number of other maladies, some of which may lead to death.

The greatest threat of listeriosis is from ready-to-eat products that do not require further cooking at home. *L. monocytogenes* in raw food that will be cooked before consumption is less of a concern to the food industry since the bacteria are killed during cooking. *L. monocytogenes* has been isolated from raw fish, cooked crabs, raw and cooked shrimp, raw lobster, surimi and smoked fish (Ward et al., 1997).

Control Measures

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Hazards from *L. monocytogenes* can be prevented by thoroughly cooking seafood and by preventing cross-contamination once the seafood is cooked. Since the infective dose of *L. monocytogenes* is thought to be small, time/ temperature abuse of food products may not be necessary to result in illness (Ward et al., 1997).

Guidelines

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FDA Guidelines

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FDA & EPA safety levels in regulations and guidance.

Canadian Food Inspection Agency Bacteriological Guidelines for Fish and Fish Products

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Growth

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Table A-1**.** Limiting conditions for pathogen growth.

Heat Resistance

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Heat resistance of *L. monocytogenes*.

Temp.		D-Value	Medium	Reference
(ºC)	(ºF)	(min)		
50	122	34.48	Blue crabmeat	Harrison and Huang, 1990
50	122	40.43	Blue crabmeat	Harrison and Huang, 1990
51.6	125	97.0	Lobster	Budu-Amoako et al., 1992
54.4	130	55.0	Lobster	Budu-Amoako et al., 1992
55	131	9.18	Blue crabmeat	Harrison and Huang, 1990
55	131	12.00	Blue crabmeat	Harrison and Huang, 1990
55	131	10.23	Crawfish tail meat	Dorsa et al., 1993
56	132.8	48.09	Mussels, brine soaked	Bremer and Osborne, 1995

57.2	135	8.3	Lobster meat	Budu-Amoako et al., 1992
58	136.4	16.25	Mussels, brine soaked	Bremer and Osborne, 1995
58	136.4	10.73	Salmon	Embarek, 1995
58	136.4	7.28	Cod	Embarek, 1995
59	138.2	9.45	Mussels, brine soaked	Bremer and Osborne, 1995
60	140	2.39	Lobster meat	Budu-Amoako et al., 1992
60	140	1.31	Blue crabmeat	Harrison and Huang, 1990
60	140	2.61	Blue crabmeat	Harrison and Huang, 1990
60	140	1.98	Crawfish tail meat	Dorsa et al., 1993
60	140	5.49	Mussels, brine soaked	Bremer and Osborne, 1995
60	140	4.48	Salmon	Embarek, 1995
60	140	1.98	Cod	Embarek, 1995
62	143.6	1.85	Mussels, brine soaked	Bremer and Osborne, 1995
62	143.6	2.07	Salmon	Embarek, 1995
62	143.6	0.87	Cod	Embarek, 1995
62.7	145	1.06	Lobster meat	Budu-Amoako et al., 1992
65	149	0.19	Crawfish tail meat	Dorsa et al., 1993
65	149	0.87	Salmon	Embarek, 1995
65	149	0.28	Cod	Embarek, 1995
68	154.4	0.15	Salmon	Embarek, 1995
68	154.4	0.15	Cod	Embarek, 1995
70	158	0.07	Salmon	Embarek, 1995
70	158	0.03	Cod	Embarek, 1995

Z-values: lobster meat 5.0ºc, blue crabmeat 8.40ºc in trypticase soy agar, crawfish tail meat 5.5ºc, mussels 4.25ºc, salmon 5.6ºc, cod 5.7ºc.

Analytical Procedures

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BAM: Detection and enumeration of *L. monocytogenes* (US FDA) Top

Food sampling and preparation of sample homogenate (US FDA) Top

Serodiagnosis of *Listeria monocytogenes* (US FDA) Top

Summary of Methods to detect the presence of *Listeria* spp. and *Listeria monocytogenes* (HC) Top

Other analytical methods

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- *Listeria monocytogenes* in Milk and Dairy Products: Selective Enrichment and Isolation Method (AOAC, 1995a)
- *Listeria* Species: Biochemical Identification Method (Vitek GPI and GNI) (AOAC, 1995b)
- *Listeria* in Dairy Products, Seafoods, and Meats: Colorimetric Deoxyribonucleic Acid-hybridization Method (GENE-TRAK *Listeria* Assay) (AOAC, 1995c)
- *Listeria monocytogenes* in Dairy Products, Seafoods, and Meats: Colorimetric Monoclonal Enzyme-linked Immunosorbent Assay Method (AOAC, 1995d)
- *Listeria* in Foods, Colorimetric Polyclonal Enzyme Immunoassay Screening Method (TECRA *Listeria* Visual Immunoassay) (AOAC, 1995e)
- *Listeria* Species: Biochemical Identification Method (MICRO-ID Listeria) (AOAC, 1995f)

Commercial Test Products

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Commercial test products for *L. monocytogenes*.

Test	Analytical Technique	Approx. Total Test Time[1]	Supplier
AccuPROBE® *Listeria* monocytogenes Culture Identification Test	Nucleic acid hybridization	18-48 h	Gen-Probe Web: www.gen-probe.com
API *LISTERIA* [Used to identify *Listeria* spp.]	Biochemical reactions	18-24 h	bioMérieux Inc. Web: www.biomerieux.com
Assurance *Listeria* EIA[2] [Used to identify *Listeria* spp. including *L. monocytogenes*]	Enzyme immunoassay	50 h	BioControl Systems, Inc. Contact: Robin Forgey 12822 SE 32nd St. Bellevue, WA 98005 Phone: 800/245-0113; 425/603-1123 E-mail: info@rapidmethods.com Web: www.rapidmethods.com
BAX® for Genus *Listeria*	Polymerase chain reaction	45 h	Qualicon, Inc. P.O. Box 80357 Wilmington, DE 19880-0357 Phone: 800/863-6842; 302/695-9400 E-mail: info@qualicon.com Web: www.qualicon.com
BAX® for Screening/*L. monocytogenes*	Polymerase chain reaction	45 h	Qualicon, Inc. P.O. Box 80357 Wilmington, DE 19880-0357 Phone: 800/863-6842; 302/695-9400 E-mail: info@qualicon.com

			Web: www.qualicon.com
Chromogenic Listeria [A differentiation test for *Listeria monocytogenes* and other species.]		42-66 h	Biomedix Contact: Claver Bundac 1105 #F North Golden Springs Dr. Diamond Bar, CA 91765 Phone: 800/674-8648 #4282; 909/396-0244 E-mail: cb4biomedx@aol.com
Dynabeads anti-*Listeria* [Used to identify *L. monocytogenes*]	Immunomagnetic Separation	48 h	Dynal Inc. Contact: Technical Service 5 Delaware Dr. Lake Success, NY 1042 Phone: 516/326-3270 E-mail: techserv@dynalusa.attmail.com Web: www.dynal.no/
EIAFoss *Listeria*	Combination ELISA and immunomagnetic separation	48 h	Foss North America, Inc. 7682 Executive Dr. Eden Prairie, MN 55344 Phone: 612/974-9892 E-mail: sales@fossnorthamerica.com Web: www.fossnorthamerica.com
GENE-TRAK *Listeria* monocytogenes Assay	Nucleic acid hybridization	48 h	Neogen Corporation 620 Lesher Pl. Lansing, MI 48912 Phone: 517/372-9200 E-mail: NeogenCorp@aol.com Web: www.neogen.com/genetrakback.htm
GENE-TRAK *Listeria* Species Assay[2]	Nucleic acid hybridization	48 h	Neogen Corporation 620 Lesher Pl. Lansing, MI 48912 Phone: 517/372-9200 E-mail: NeogenCorp@aol.com Web: www.neogen.com/genetrakback.htm
ISO-GRID Method for *Listeria* spp.	Membrane filtration	24 h	Neogen Corporation 620 Lesher Pl. Lansing, MI 48912 Phone: 517/372-9200 E-mail: NeogenCorp@aol.com Web: www.neogen.com/isogridgen.htm
Listeria	Culture	24 h	Contamination Sciences LLC Contact: Robert Steinhauser 4230 East Towne Blvd., Suite 191 Madison, WI 53704 Phone: 608/825-6125 E-mail: bsteinha@contam-sci.com Web: www.contam-sci.com
Listeria Rapid	EIA	42 h	Oxoid, Inc.

Test[2] [Used to identify *Listeria* spp. including *L. monocytogenes*]			Contact: Jim Bell 217 Colonnade Rd. Nepean, Ontario K2E 7K3 Canada Phone: 613/226-1318 E-mail: jbell@oxoid.ca
Listeria-Tek ™[2]	ELISA	48 h	Organon Teknika Corp. 100 Akzo Ave. Durham, NC 27712 Phone: 800/654-0331; 919/620-2000 E-mail: casey@orgtek.com
ListerTest ™[2] [Used to identify *L. monocytogenes*]	Immunomagnetic separation	24 h	Vicam, L.P. Contact: Brian Kraus 313 Pleasant St. Watertown, MA 02472 Phone: 800/338-4381 E-mail: vicam@vicam.com Web: www.vicam.com
Microbact 12L[2] [Used to identify *Listeria* spp.]	Biochemical identification system	4-24 h	BioControl Systems, Inc. Contact: Robin Forgey 12822 SE 32nd St. Bellevue, WA 98005 Phone: 800/245-0113; 425/603-1123 E-mail: info@rapidmethods.com Web: www.rapidmethods.com
MICRO-ID Listeria [2] [Used to identify *Listeria* spp.]	Latex agglutination	24 h	Remel Contact: Customer Service 12076 Santa Fe Dr. Lenexa, KS 66206 Phone: 800/255-6730; 913/888-0939 E-mail: remel@remelinc.com Web: www.remelinc.com
Probelia PCR System [Used to identify *L. monocytogenes*]	Polymerase chain reaction	30 h	BioControl Systems, Inc. Contact: Robin Forgey 12822 SE 32nd St. Bellevue, WA 98005 Phone: 800/245-0113; 425/603-1123 E-mail: info@rapidmethods.com Web: www.rapidmethods.com
Reveal® for *Listeria*[2] [Used to identify *Listeria* spp.]	Sandwich ELISA	48 h	Neogen Corporation 620 Lesher Pl. Lansing, MI 48912 Phone: 517/372-9200 E-mail: NeogenCorp@aol.com Web: www.neogen.com
TECRA Listeria Visual Immuno Assay[2]	ELISA	48 h	International BioProducts Contact: Bob Ward 14780 NE 95th St.

[Used to identify *Listeria* spp.]			Redmond, WA 98052 Phone: 800/729-7611; 425/883-1349 E-mail: myeager@intlbioproducts.com Web: intlbioproducts.com
Transia Plate *Listeria*	ELISA	48 h	Diffchamb AB FO Petersons Gata 32 SE-421 31 Västra Frölunda, Sweden Phone: +46 -31-742 33 50 E-mail: market.dept@diffchamb.se Web: www.diffchamb.se
Transia Plate *Listeria Monocytogenes*	ELISA	45 h	Diffchamb AB FO Petersons Gata 32 SE-421 31 Västra Frölunda, Sweden Phone: +46 -31-742 33 50 E-mail: market.dept@diffchamb.se Web: www.diffchamb.se
Vidas LIS[2] [Used to identify *L. monocytogenes*]	Enzyme linked fluorescent assay	48 h	bioMérieux Inc. Web: www.biomerieux.com
Vidas LMO [Used to identify *L. monocytogenes*]	Enzyme linked fluorescent assay	48 h	bioMérieux Inc. Web: www.biomerieux.com
VIP for *Listeria*[2] [Used to identify *Listeria* spp. including *L. monocytogenes*]	Visual immunoprecipitate	48 h	BioControl Systems, Inc. Contact: Robin Forgey 12822 SE 32nd St. Bellevue, WA 98005 Phone: 425/603-1123 E-mail: info@rapidmethods.com Web: www.rapidmethods.com

[1]Includes enrichment
[2]AOAC Approved

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