

## Listeria Monocytogenes: An Overview

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### Abstract:

*Listeria monocytogenes* is a foodborne pathogen which is cosmopolitan. It can be found in raw plants, food, soil, and water. *L. monocytogenes* with Listeriosis infection can be mild but to cross the epithelial barrier of the intestinal tract, the fetoplacental barrier and the blood-brain barrier depends upon the capability of the pathogen which can result into several other illnesses especially on pregnant women and the person with the low immune system. It can also have the ability to form biofilms. In food processing, it is resistant to many of stress imposed such as salt. As a public health threat, in terms of cost of analysis *L. monocytogenes* is one of the major economic burdens on industry. Good hygienic practices, Sanitation, and HACCP should be implemented to prevent the growth of this bacterium in food industries. Appropriate methodologies are also required for the isolation and detection. In this paper, we will discuss the characteristics, symptoms, transmission, diagnosis, growth, and control of *Listeria monocytogenes*.

**Keywords:** Food, Symptoms, *Listeria monocytogenes*, Temperature.

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## Introduction

The organism belongs to order Bacillales, Family Listeriaceae, and Genus *Listeria* is *Listeria monocytogenes*. This bacteria cause foodborne diseases. *Listeria* grow at low temperature ( $-0.4^{\circ}\text{C}$ ) and cause listeriosis. Listeriosis is common in newborn infants, pregnant women, the elderly and individuals with compromised immune systems. In addition to possess cold tolerance, *L. monocytogenes* is also capable of living many more food-related stresses including high osmolality and low pH.

In 1990s improved control measures were applied which shows a great reduction in the growth and spread of *L. monocytogenes* in many food categories, mainly in meat products..

In raw foods of both plant and animal origin, *L. monocytogenes* is and sometimes it can also be found in cooked foods due to post-processing contamination. Therefore from foods such as raw and unpasteurized dairy products, vegetables, fermented meats and etc. has been isolated.

## Characteristics of Organism

The organism which belongs to order Bacillales, Family Listeriaceae and Genus *Listeria* is *Listeria monocytogenes*. There are 8 species which are contained by genus *Listeria*, named as *L. gravis*, *L. innocua*, *L. Ivanovic*, *L. monocytogenes*, and *L. welshimeri*, and two new species, *L. marthii*, and *L. rocourtiae*. In *Listeria monocytogenes* 13 recognized serotypes are present. The bacterium is a small, non-capsulated, Gram-positive, non-sporulated, aerobic or facultatively anaerobic, pleomorphic, oxidase negative, catalase positive, rod-shaped which ferments D-rhamnose, not D-xylose. Due to peritrichous flagella organism is motile at  $20-25^{\circ}\text{C}$ . On blood agar, beta hemolysis is produced by the organism and hold both somatic (O) and flagella (H). A biofilm is produced by them which allow the bacteria to attach to the solid surface and then proliferate which further becomes difficult to remove. It can survive in  $1.5$  to  $45^{\circ}\text{C}$ ,  $4.3$  to  $9.6$  pH and  $5$  to  $10\%$  Carbon dioxide. *L. monocytogenes* can be found in the non-living environment such as soil, silage, sewage, and manure as well as in a wide variety of animals and plants commonly used for human consumption. It is ubiquitous in circulation in milk, water, Soil and in plants *Listeria monocytogenes* can live for a long time.

## Growth and its Control

### Growth

Temperature: Ideal  $37^{\circ}\text{C}$ , range  $-1.5$  to  $45^{\circ}\text{C}$ .

pH: Ideal  $7.0$ , range  $4.4-9.4$ .

Temperature: Survives in low temperature.

Temperature: this is quickly inactivated at temperatures above  $70^{\circ}\text{C}$ . D time at  $50^{\circ}\text{C}$  can be in the order of hours, at  $60^{\circ}\text{C}$  5-10 min,  $70^{\circ}\text{C}$  approximately 10 sec.

Sanitizers/Disinfectants: All samples of inoculated mung beans are not.

Sanitizers/disinfectants: in the absence of organic matter (aldehydes, phenols, alcohols, ethanol/phenols, substituted, dichlorine, quaternary ammonium compounds (QACs)) are generally effective in the absence of organic matter.

## Transmission

In listeriosis, numerous manners of transmission have been described. Ingestion of *L. monocytogenes* in food is one of the most important routes. In peripartum and utero, the organism can be vertically transmitted from mother to fetus. There are also many other modes for transmission less frequent possible modes include animal to person transmission.

## Symptoms

A wide range of infection like bacteremia, pneumonia, endocarditis, and osteomyelitis including gastroenteritis (vomiting and diarrhea also called the "stomach flu") can be caused by *Listeria monocytogenes*. The incubation period of the disease is 7 to 60 days. In a normal healthy person, infection produces a mild influenza-like disease or it may be asymptomatic. In a serious concern, meningitis which is frequently accompanied by septicemia is one of the most common found diseases.

Infection in fetus is extremely common which can cause to abortion, miscarriage, or delivery of an extremely ill infant. The persons with the weakened immune system are found to be at more risk of serious illness. The illness includes meningitis, pneumonia, and listeriosis etc. The growth of listeriosis may range from few days to three weeks. The time of gastrointestinal symptoms is also unknown but it is probably greater than 12 hours. Due to *L. monocytogenes*, the diseases which are clinical are more frequently recognized by veterinarians, especially as meningoencephalitis in ruminants.

## Diagnosis

In the clinical practices, serological tests are considered not specific useful. The diagnosis of the diseases can be done by culturing the organism from cerebrospinal fluid, blood, and food. In cases of

gastroenteritis if *L. monocytogenes* is suspected from stool it can be isolated but there is a need that specimen needs to be transported under cool conditions and within the 4 hours of collection the patient need to arrive in the laboratory. In exception cases like if the transport is delayed it can be cooled at 4°c for up to 48 hours. There is also a need for stool sample for the submission either unpreserved or preserved. It is suggested that lithium chloride-phenyl ethanol-moxalactam medium must be used for isolation. Because the media selected for stool cultures normally suppress the growth of *Listeria*. Agar is used as medium for identification.

### Methods for analysis of *L. Monocytogenes*

*L. monocytogenes* occurs in very small colonies in the food articles, therefore it is important to include enrichment steps which increase the number of *L. monocytogenes* to allow detection and the recovery of injured/stressed cells.

The most commonly used analysis methods are three

1. The International Standard (ISO-11290) method which uses a two-step enrichment in Fraser broth.
2. The United States Department of Agriculture (USDA) method which uses a two-step enrichment in University of Vermont media (UVM).
3. The One-broth *Listeria* method which has been approved for use by the Association Française de Normalization (AFNOR)

*Listeria* has also been explored. Through PCR *Listeria* specific genes should be amplified and quantifying is done by the fluorescent probe attached to the DNA fragments. For the straight detection of *L. monocytogenes* in food PCR is not suitable because it lacks the essential sensitivity.

### Review of literature:

**Rocourt, et al. (2003).** There is strongly need for more research on pathogens in foods and MRA should be used to guide such research. In public health, scientist plays a very vital role by providing risk assessors with the necessary data.

**Gambarin, et al. (2016)** temperature is a factor preventing the growth of *L. monocytogenes*. The

highest proportion related to serotype 1/2a and the genetic characterization using ribotyping validates the genomic variability of *L. monocytogenes*.

**Buchanan, et al. (2017)**In the understanding of *L. monocytogenes*, there is a need to further study assisting risk evaluators and risk managers for the better understanding of the organism and its control. By the food industry control measures can be enhanced by better recognition of growth/no growth conditions, knowledge about strain differences, particularly in complex foods illumination and their impact of persister cells and more comprehensive documentation of outbreaks leading to better understanding of the dose-response.

international collaborative studies.

**Pal, et al. (2017)** the principle cause of listeriosis is *Listeria monocytogenes*. It is a well-known developing food borne pathogen, which primarily affects pregnant women, newborn infants, adults and the elderly with the weak immune system. To minimize and control the infection better diagnosis proper drug treatment is important.

### Conclusion

The main cause of listeriosis is *Listeria oncogenes* which results in high mortality and morbidity. It is the most emerging food borne pathogen, which mainly affects the person with the low immune system, pregnant women and newly born infants. Through the injection of contaminated food infection occurs which will give a result from minor fever to serious problem. For the detection of *L.monocytogene* in foods, the most sensitive scientific method is Real-time PCR. To the detection and identification of this pathogen the technique which is greatly contributed is molecular diagnostic techniques. In this, the application of a combination of two or more procedure is more powerful and biased for the tracking of *L. monocytogenes* strains. On the other side, the regulation should be designed to minimize the use of *L.monocytogene* in foods for the safety of health.



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