An Emerging Food Borne Listeriosis (L. Monocytogenes) in Society, a Mini Review World Wide and in India

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ABSTRACT
Listeriosis is a rare but potentially serious and harmful infection caused by Listeria monocytogenes. The main route of transmission is through the consumption of contaminated food (Food borne). It generally affects elderly people, pregnant women and immunosuppressed hosts, although cases are also seen in immunocompetent adults and children. Listeria monocytogenes is a short, non-spore-forming gram-positive bacillus. It is a facultative intracellular pathogen, and therefore it shows a complex pathogenesis. L. monocytogenes has the ability to cross the intestinal barrier, the placenta and the blood-braid barrier producing gastroenteritis (GI), maternal-fetal infections and meningoencephalitis. It is most commonly diagnosed from a positive culture of a sterile site. L. monocytogenes cause very serious invasion and often life threatening disease.

Keywords- Foodborne diseases, Food contamination Listeria Spp, invasive Listeriosis, L. monocytogenes

I. INTRODUCTION
According to the world health organisation, (WHO) microbes cause 25% of the total 57 million annual deaths that occur worldwide and this proportion is significantly higher in the developing world.

Food-borne pathogen, including its epidemiology, its incidence and growth in foods, and the virulence factors involved in human disease specially gastroenteritis. In recent years, there is an increasing demand for ready-to-eat (RTE) foods because people have realized the importance of a healthy diet and healthy life style. However the increasing consumption of raw produce, including vegetables and fruits was recognized as a source of microbiological food borne out breaks in many parts of world. [1,2]

The genus Listeria has emerged as an important food borne pathogen which causes listeriosis in humans and animals. Listeria a genus of gram of positive bacteria containing is currently 17 spp., including 9 listeria spp. (since 2009). (L. Monocytogenes, L. innocua, L.welshimeri, L. marthii, L. inanovi, L. seeligeri, L. grayi, L. roccairtae, L. fleischmamni, L. newyorkensis, L. grandensis, L. riparia, L. fordianensis, L. cornellensis, Lriparia, L. aquatica and L. boorlai. Among these species, L. monocytogenes is know to be pathogenic to human, causing listeriosis, which is one of the most virulent food borne diseases. [3,4].

Listeriosis is a rare but potentially serious infection, caused by L. monocytogenes. The CDC find 31 foodborne pathogens to be the cause of foodborne illnesses and amongst these pathogens L. monocytogenes is ranked in top 5. This microorganism can be found in soil, vegetation and animals. The main route of transmission is through the consumption of contaminated food, although there have also been cases of direct transmission from animals to humans and between humans. It usually affects older people, pregnant women and immunocompromised (including neonates), although cases are also described in adults and immunocompetent children [5-8] unlike other infections associated with food consumption, listeriosis has a high mortality rate (20-30%) [9].

L. monocytogenes as an important food- borne pathogen became evident in 1980s, after several food-borne outbreaks proved to be caused by it [10-12]. After that, several reports have been recorded of food-borne listeriosis, both epidemics and sporadic cases, almost all kinds of foods [13-17]. In human 99% listeriosis cases are food-borne [18]. The clinical symptoms of invasive Listeriosis typically begin 20-30 days after the ingestion, even though incubation period can be up to 72 days [19]. Invasive Listeriosis is rare, and the most typical symptom is mild gastro-enteritis with fever, headache, nausea, diarrhoea, and abdominal pain [20]. Cutaneous and eye infections have rarely been reported, mainly in farmers and veterinarians in direct contact with afterbirths and infected foetuses [21,22]

Genus Narration
The Listeria spp. Is a gram-positive, rod shaped organism that can grow in aerobic and anaerobic conditions? The species with a diameter of about 0.5 m and a length of 0.5-2.0 m. They are facultative anaerobes with no capsule. Moreover, they are catalyse- positive, oxidase-negative and motile at 20- 25°C due to peritrichous flagella but non- motile at 37°C [23]. Listeria produces flagella at room temperature and exhibit a tumbling motion when examined in broth and a swarming motility can be observed in semi-soft agar at 30°C [24], but flagella are not produced at 37°C [25].

Morphology
Ritz (2001) [26] studied the morphology of L. monocytogenes through electron microscope. They
described the observations as the average length and diameter of the organism is 4 micrometer and 0.4 micrometer and the cell surface are smooth.

**Geographic Distribution**

*L. monocytogenes* is found worldwide and is widely distributed in the environment.

### II. L. MONOCYTOGENES IN FOOD

Contamination of foods by *L. monocytogenes* can occur at any point in the food chain, including on farms, in food processing plants, in retail establishments and in the home [27-29]. *L. monocytogenes* can be detected in a wide range of foods, including both raw and processed foods. Many foods such as raw vegetables, soft cheeses, and hot dogs have been implicated in listeriosis outbreaks, but *L. monocytogenes* also can be isolated from other foods such as pork, fermented sausages, fresh produce and fish products [30]. Listeria has been shown to survive within cultured buttermilk, butter and yogurt; of which these specific foods primarily depend on adequate fermentation to yield a low product pH that does not support Listeria growth. Many studies have shown that a wide variety of meats can become contaminated with *L. monocytogenes* and most contamination is observed on meat product and poultry. For example, [31] reported that between 12- 60% of raw chicken was contaminated with *L. monocytogenes* and young birds were colonized by this human pathogen at a higher rate. Many studies have shown that the ability of *L. monocytogenes* to survive and grow on meat is dependent on temperature, pH of the meat, type of tissue, and initial miroflora already present on the meat’s surface [32]. Since *Listeria monocytogenes* is found in soil and water, raw vegetables can become contaminated from the soil or from manure used as fertilizer [33]. An interesting new study show that the high growth potentials of *L. monocytogenes* on spinach alongside the limited visual deterioration highlight the potential risks of consuming this raw ready-to-eat food product when contaminated (inoculated). (Growth potential of *Listeria monocytogenes* on refrigerated spinach and rocket leaves in modified atmosphere packaging-Food 2020,9). Animals (i.e., wildlife and domestic livestock) can be asymptomatic carriers of *L. monocytogenes* and contaminate foods of animal origin such as dairy and meats through asymptomatic shedding in milk and feces. Not only can *L. monocytogenes* be isolated from raw foods (e.g. vegetables, uncooked meats), but it also can be detected in processed foods such as soft cheeses and delicatessen meats [34-36]. Although Listeria can easily be inactivated by cooking and pasteurization [37], it remains a significant problem in ready-to-eat foods that may become cross-contaminated by exposure in the food processing plant environment after cooking but before packaging [38].

### III. MODE OF TRANSMISSION

The most common transmission route of *L. monocytogenes* to humans is via the consumption of contaminated food. However, *L. monocytogenes* can be transmitted directly from mother to child (vertical transmission), from contact with animals and through hospital acquired infections [39]. Healthy individuals can be asymptomatic carriers of *L. monocytogenes*, with 0.6 - 3.4% of healthy people with unknown exposure to Listeria being found to shed *L. monocytogenes* in their faeces. However, outbreak research have shown that Listeriosis patients do not always shed the organism in their faeces [40,41]. Therefore the role of healthy carriers in the transmission of *L. monocytogenes* is unclear.

**Incubation Period**

The delay between the consumption of contaminated food and the appearance of the first symptoms of illness is called the incubation periods. This ranges from hours to days (and rarely months or even years, such as in the case of foodborne “listeriosis”, depending on the agent, and on how much was consumed. If symptoms occur within 1 to 6 hours after eating the food, it suggests that it is caused by a bacterial toxin or a chemical rather than live bacteria.

The long incubation period of many foodborne illnesses tends to cause sufferers to attribute their symptoms to gastroenteritis (GI).

During in the incubation session, microbes pass through the stomach into the intestine, attach to the cells lining the intestinal walls, and begin to multiply there. Certain types of microbes stay in the intestine, some produce a toxin that is absorbed into the bloodstream, and some can directly invade the deeper body tissues. The symptoms produced depend on the type of microbe. [42].

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**Figure: Foodborne Listeriosis (L.monocytogenes) Environment to human cycle**

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IV. LISTERIOSIS WORLDWIDE AND IN INDIA

Listeriosis, a bacterial disease has emerged as a major food borne disease during the past two decades, since it has a high case fatality rate (approximately 20 to 30%) [43]. Listeriosis, as an important cause of severe illness account to 3.8% of food-borne hospitalization and 27.6% of food-borne deaths in the US [44]. The severity of the disease includes meningitis, septicemia and abortion. It also has a long incubation time and a predilection for individuals who have an underlying condition, which leads to impairment of (T-cell mediated) immunity. In 1981, the 1 documented and confirmed food-borne cases outbreak occurred at Nova Scotia, Canada. The outbreak was linked to a food produce, narrowly prepared coleslaw. The route of transmission of L. monocytogenes by food was evident only in 1980s after a series of outbreaks [45], almost all cases of Listeriosis are food-borne are [44,46,47]. Recently the proportion of Listeriosis cases due to food-borne transmission has been estimated to be 99% [47]. Due to poor net working, reporting system on the disease outbreak and food-borne disease surveillance, very limited information is available on the prevalence of food-borne disease in India. However, despite, the poor information management system on the incidence and epidemiology of diseases in the Indian subcontinent, reports on sporadic cases of both animal and human Listeriosis could be traced which dates back to the 1930s. Animal Listeriosis in India traces back to 1935 in Hyderabad states in sheep as circling disease. The first documented report was in 1950 from sheep in madras [48]. Subsequently there have been a few other reports on the disease in India [49]. Human Listeriosis cases have also been reported in India. Though not phenomenal, the number of human Listeriosis case in India, have been in the rise with reports on sporadic cases and incidence in clinical samples. Probably, it is for this reason that Chugh in 2008 [50] has quoted L. monocytogenes to be a growing threat and Listeriosis emerging food-borne diseases in India. A few of the significant clinical reports on the incidence of Listeriosis in the Indian sub-continent is detailed below. [51] were the first to discuss on human Listeriosis in India. Bhujwala et al. (1973) [52] reported a pilot study on the genetic Listeriosis in Delhi. Again, in 1975, according Bhujwala and Hingorani, reported on the perinatal Listeriosis in India. [53]. studied neonatal Listeriosis in north India in 1981, in the same year Gogate and Deodhar, [54] reported a case of meningitis caused by Listeria infection. With a break for about 15 odd years, reports on Listeriosis, emerged yet again in 1977 with the report of Gupta [55]. They reported on opportunistic Listeria infection of an infant Gupta in the year 2003 made a report of a sporadic case of Listeriosis in the second trimester of pregnancy. [55]. in the year 2005 reported on neonatal Listeriosis. [7], reported Meningoencephalitis caused by L. monocytogenes in an immunocompetent previously healthy 20 month old female child. Though Listeriosis and L. monocytogenes may not be seen as potential clinical threat in India today, the probable risk that it might pose in the year to come, cannot be ignored. As against the global trend in Listeria and Listeriosis research, the contribution from the Indian subcontinent is still naive.

V. CONTROL IN THE FOOD CHAIN

Listeria monocytogenes can contaminate at various stages of the food chain to contribute to contamination of the finished product. Key factors that food handlers should be aware of, whether in a domestic or commercial kitchen, are:

- adherence to ‘use by’ dates
- advice for vulnerable groups on foods to avoid
- washing hands thoroughly and frequently using soap and warm water
- ensure food is cooked thoroughly as this will kill any bacteria present (cook until it reaches an internal temperature of 75°C).

VI. CONCLUSION

Raw and contaminated food is the most common mode of L. monocytogenes (Listeriosis) infection is a really dangerous for all countries populations, although the incidence and true impact of this food borne (gastroenteritis) disease is underestimated. The healthcare professional should be aware of risk factors, forms of transmission and recognize patients with suspected infection in time, especially immunosuppressed patients, pregnant women and those at the ends of life, due to the high mortality that listeriosis may have in this group of patients. Being able to suspect the disease early will allow for initial empirical treatment that can modify the prognosis, for which Gram staining and cultures are essential to identify this bacterium. Also, in many Latin American countries efficient food control mechanisms should be established, as well as educating the general population and especially the high-risk population in the strategies of prevention of this disease that can have fatal results.

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