Contamination of Dairy Products by 
Listeria monocytogenes and Its Control

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Abstract: As per a 2010 estimate, among the foodborne pathogens, Listeria monocytogenes is one of the most lethal pathogens that cause 1,591 illnesses and 255 deaths in the United States [1]. In India, human listeriosis cases have emerged to be evident and there have been a series of reports to substantiate this. Listeria monocytogenes is the only member of this genus that is a human pathogen is pathogenic for animals as well and human being. Listeria monocytogenes is a gram positive intracellular non spore forming, facultative anaerobic pathogen which is associated with a number of clinical entities. In humans the clinical manifestation for listeriosis is sepsis, meningitis and miscarriage in susceptible host. Many animal species are infected with Listeria monocytogenes. In ruminants the clinical manifestation is present as meningoencephalitis, septicaemia, and abortions. The bacteria can enter into food processing chains through a number of ways. The bacteria have the ability to survive long periods of time in soil, water and plants and can grow at extremely low temperatures ranging from 2 ºC to as high as 45 ºC under adverse conditions makes it a great server of food poisoning.

1. Contamination of milk and milk products by L. monocytogenes

Food borne transmission through improperly processed milk and milk products is the most common source of infection. Unfortunately, in our country most of the consumed milk and dairy products are not prepared under hygienic conditions. Ignorant producers utilize milk that is most often not boiled enough in the production of their products. This too, obviously affects the health of the consumer. Cross-contamination, which can occur within the environment of food-processing equipment, is considered to be a possible source of Listeria contamination in processed food. Listeriosis outbreaks have mostly been linked to consumption of raw milk or cheese made of unpasteurized milk [2]. Incorrect milk pasteurization and its subsequent contamination are the most possible explanations for the presence of pathogens in pasteurized milk. Some of the milk borne bacteria from cows with bovine mastitis may survive the pasteurization and replicate at refrigeration temperatures. When cattle are infected with L. monocytogenes, the organism is excreted in the milk. Contamination of milk may be due to environmental factor and poor hygiene practice [3]. According to Kousta et al, important sources of contamination during the handling and processing might be the workers as well. The sources of contamination of Listeria spp. in raw milk are probably insufficient hygiene during milking so also storage and transport of milk. L. monocytogenes may directly contaminate milk as a consequence of listerial mastitis, encephalitis or Listeria related abortion in cattle [4]. Rawool et al reported overall occurrence of L. monocytogenes in 0.55% of 243 cattle and buffaloes with subclinical mastitis in India [5]. Similarly, reports have also been made by Aurora et al. on the incidence of L. monocytogenes in milk based ready-to-eat foods [6]. The dairy-related listeriosis outbreaks reported during the mid-1980s has prompted scientists worldwide to determine the extent of listeria contamination in raw milk and in pasteurized dairy products including milk, ice-cream, ice cream
Contamination in raw milk

The contamination of L. monocytogenes in raw bovine milk is of great concern from public health point of view as it can serve as a source for the transmission of human listeriosis. Despite the high incidence of contamination of raw milk, it carries a low risk of listeriosis transmission because of the heat treatment prior to consumption. However, considering the level of incidence of L. monocytogenes in raw milk, it seems likely that L. monocytogenes may be transferred to milk products or milk that have not been correctly pasteurized or that have been contaminated post-pasteurization with raw milk. The 1983 listeriosis outbreak in Massachusetts was supposedly associated drinking a particular brand of pasteurized milk safety questions. Overseas testing has shown that up to approximately 10% of raw milk samples contain L. monocytogenes [7].

Contamination in ice-cream

Ice-creams are consumed with pleasure by general public especially children due to its contents of sweeteners, aromatic compounds and various fruits and is known to be richest in terms of content among dairy products [8]. According to WHO reports on surveillance data of L. monocytogenes, contamination in ice cream in various countries varied from 0 - 5.5% [9]. The raw material from which ice cream is made, i.e. milk, should be considered a potential source of L. monocytogenes. Pasteurization of raw milk is therefore an important step in assuring the safety of ice cream. In normal circumstances ice cream is stored and sold in the frozen state. While L. monocytogenes is known to grow at temperatures below 0° C, no growth should occur at the temperatures at which ice cream is normally stored [10]. However, any Listeria present as a result of post-pasteurization contamination is likely to survive freezing. One study has shown that essentially 100% viable cells of L. monocytogenes could be recovered from ice cream after 14 weeks of storage at -18°C [11]. The pH of ice cream is most of the times close to neutral and hence it does not cease the growth of L. monocytogenes.

Contamination in curd

Curd (dahi) or yoghurt was among the first dairy products to be mass produced using pure mesophilic bacterial cultures. Viability of L. Monocytogenes in the presence of mesophilic lactic acid bacteria were examined by Schaack and Marth. It was found that L.monocytogenes can enter either before the fermentation of milk as a contaminant or afterward as a contaminant of the finished product. Acid development and differences in acid tolerance/injury during manufacture play a major role in determining the fate of listeria in yoghurt or curd [12].

Contamination in cheese

Cheeses offer a suitable environment for the survival and growth of Listeria monocytogenes, allowing this pathogen to display tolerance responses that can favour its presence in cheese and persistence in dairy processing plants. In general, soft cheeses made with unpasteurised milk are of much higher L. monocytogenes risk than hard or extra hard cheeses made with unpasteurised milk as the formers are likely to be less acidic and contain more moisture, which provide a favourable environment for the growth of L. monocytogenes, than the latter. A recent risk assessment study conducted by Food Standards Authorities in Australia and New Zealand also pointed out that the estimated L. monocytogenes risk from the consumption of certain raw milk soft cheeses i.e. feta and camembert is low in the general population but is high in the susceptible population. However, the L. monocytogenes risk upon the consumption of raw milk cheddar cheese (a type of hard cheese) and extra hard cheese in the general and susceptible populations is negligible and low or very low respectively [13].

Important guidelines for prevention and control of Listeria monocytogenes in dairy industry

- Ensure that milk is adequately pasteurized.
- Ensure that there is no post-pasteurization contamination.
- Use only L. monocytogenes - free milk in the manufacturing of soft cheeses, ice creams, flavoured milk, etc.
- Avoid undercooking of any food that utilizes dairy products like milk or cheese and avoid milk or dairy products such as soft cheese made from unpasteurized milk.
- Where chill storage of preheated dairy products is required ensure higher internal temperatures (minimum 75° C) are reached.
- Limit the shelf life of all products, heated or unheated, where growth of L. monocytogenes is feasible to a maximum of 5 days.
- Maintain good food and personal hygiene and avoid cross-contamination.
- Manufacturers must provide sufficient information on food label for the
consumers to make informed food choices.

- Compliance with the Good Manufacturing Practices (GMPs) is important
- Observation of Hazard Analysis Critical Control Points (HACCP) is mandatory and the timely surveillance of the pathogen in the milk processing environment.

7. Conclusion

From the available reports it is concluded, that low temperature may provide suitable environment for *Listeria* and secondary contamination are also reflected in the frequency of isolation. It is clear that unless the ecology of the *Listeria* is fully understood, complete control of disease caused by *Listeria* particularly *Listeria monocytogenes* will not be possible [14]. Therefore an efficient reporting system is required that will attempt to register every individual case of incidence. This system should lure the reporting of the cases by a clinician, private or public to a common repository. By such a system the growing threat can be pre-empted well in advances and averted. Though Listeriosis and *L. monocytogenes* may not be seen as potential clinical threat in India today, with the increasing trend of transnational spread and emerging diseases, the probable risk that it might pose in the years to come, cannot be ignored [15]. Thus there is need to channelize more research on this organism and as far as India is concerned, being majority vegetarian population, there should be an efficient screening system for dairy products before they enter food chain so as to prevent the milk borne zoonoses and secure public health.

8. References

10. Indian Food Control 2000;11:77-83