

The history of listeria biology essay



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Salmonellosis, Shigellosis, Yersinosis and many other infectious diseases were named after the one who discovered them unlike Listeriosis. Once the causative agent was discovered by Murray, Webb and Swann, generic names such as bacterium monocytogenes was used and finally Listeria (Pirie) to honor Dr. Lister, the discoverer of antiseptics. Hence, in the past the disease was known as Listeriosis until, Listeria came into the general usage.

Listeria was first known to be the causative agent of epidemic and sporadic cases in 50 species of animals, now the disease has been appearing on an increasing rate in the population of mankind.

In 1926, Murray, Webb identified Listeria Monocytogenes and the bacterium was named by Swann. The bacterium was then renamed by Pirie in 1927 and was given its current name, Listeria Monocytogenes.

In 1891, doctors in France and Germany discovered a gram positive bacterium in samples of tissues of patients who suffered and died from a disease similar to Listeriosis. In 1929, Nyfeldt described the first confirmed report of Listeriosis in humans caused by Listeria Monocytogenes.

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Characterization of Listeria Monocytogenes.

Listeria Monocytogenes is a small highly motile gram positive rod. It is a non spore-forming cocco-bacillus, facultative anaerobe which is catalase positive.

These ubiquitous saprophytes are widespread in nature that is they can be found in soil and water. Vegetables can get contaminated if the soil, manure or the water used is contaminated. The bacterium can also be carried away by both wild and domestic animals that may apparently appear healthy.

The bacterium is an opportunistic pathogen. It is capable of surviving and multiplying outside animal hosts and in quite simple nutrient medium.

(Chapman and Hall, 1996.). It grows under refrigeration conditions from 1°C up to 44°C. However, its growth rate decreases below 1C and it is easily destroyed by heat.

Normally pasteurization and cooking kill Listeria, but in certain ready-to-eat food, it can be found. This is due to contamination which occurs prior to packaging.

Serology:

Listeria Monocytogenes can be further characterized based on the presence of specific heat stable somatic (O) and heat-labile flagella (H) antigens.

Based on the “ O” and H” antigens, strains of Listeria Monocytogenes, isolated from pathological sources are subdivided into serotypes: 1/2a, 1/2 b, 1/2c, 3a, 3b, 3c, 4a, 4ab, 4b, 4c, 4d, 4e, 4f, 5 and 6. Serotypes 1/2a, 1/2b and 4b are responsible for greater than 95% of all human infections (Frances Pouch Downee, Keith Ito, 2001).

Factors affecting growth and survival of Listeria Monocytogenes.

Listeria Monocytogenes is a psychotropic bacterium that is it has the ability to resist the cold temperature of refrigeration. However, Listeria

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Listeria monocytogenes is also thermo tolerant when subjected to temperatures above the optimum.

The broad pH range for growth for *Listeria monocytogenes* allows it to survive. pH 7.0 – 7.5 is the optimum pH for the growth of *Listeria monocytogenes* (Dean, 1990).

The bacteria can resist a high concentration of salt that is an environment with a low water potential. It has been shown that the organism can tolerate environments of 25.6 % NaCl for at least 132 days at 22°C and 5 days at 37°C (Adams; 2001; Lovette, 1989).

Moreover the presence of other microorganisms in the same medium (on the same contaminated food) can cause a decrease in the population of *Listeria monocytogenes*.

Listeriosis:

Also known as the Circling Disease or Silage sickness, Listeriosis is a sporadic bacterial infection caused by *Listeria monocytogenes*. It is a worldwide disease and a serious food borne disease for humans. The term Listeriosis encompasses a wide variety of disease symptoms that are similar on animals and humans.

Persons of advanced age, pregnant women, new born and adults with infected immune systems are normally prone to attract this disease. A normal person without those criteria mentioned above can also be affected. He can be infected by consuming contaminated food. Babies may get

infected at birth itself if their mother had consumed contaminated food during pregnancy.

According to the world health organization (WHO), outbreaks of Listeriosis have been reported from many countries, including Australia, S Switzerland, France and the United states. Two recent outbreaks of Listeria Monocytogenes in France in 2000 and in the USA in 199 caused by contaminated pork tongue and hot dogs.

CASES IN MAURITIUS MISSING!!!!!!!!!!!!

Health risk of listeria:

Hayes (1992) considered Listeria Monocytogenes as a low grade pathogen since there is no clinical manifestation in healthy individuals upon ingestion of low numbers of viable cells. According to the center for food security and public health 1-10 % of the population is thought to carry Listeria Monocytogenes asymptotically in the intestines (May, 2005).

Vomiting, Nausea, Cramps, Diarrhea, severe headache, constipation ad persistent fever are the symptoms that may occur suddenly. Meningitis encephalitis is the infection of the brain and its surrounding tissue.

Septicemia is the poisoning of blood caused by listeria. The overall mortality rate in the group of susceptible people mention in section.... Are 20 -30%.

Listeria Monocytogenes can be identified in tissues using ELISA, PCR and other molecular techniques. It is treated with antibiotics depending on the form of the disease.

Mode of invasion and spread of Listeria in host cells:

Listeria Monocytogenes is acquired by ingestion. The bacterium must find and adhere to the intestinal mucosa or the intestinal crypt cells, which are the only undifferentiated mucosal cells. Once the bacterium is phagocytosed, it becomes enclosed in a phagolysosome, a sub cellular organelle. Normally the low pH and the contents of the phagosomes are toxic to microorganism, however, environment of low pH causes Listeria Monocytogenes to produce hemolysin, Listeriolysin O (LLO). LLO lyses the cell membrane of the phagolysosome and this causes release of the Listeria into the cytoplasm. According to F. S Southwick and D. L Purich all pathogenic strains of Listeria produce Listeriolysin-O which is important for their escape and pathogenesis.

Once in the cytoplasm, the bacteria multiply and proliferate and the bacteria become surrounded by an electron-dense material. The bacteria are then known to be polarized at one end. The electron-dense material give the bacterium an elongated protrusions form and filopods which are in turns ingested by adjacent cells and the cycle begins anew.

Spreading from cell to cell without directly being in contact with the extracellular environment is how Listeria Monocytogenes invade the cells of its hosts.

Isolation of Listeria Monocytogenes:

Since there has been increasing interest in the presence or absence of Listeria Monocytogenes in foods, as a result of some substantial outbreaks of food borne listeriosis in North America and Europe, there has been a vital

need to develop methods to isolate it in various type of food. Several methods such as ELISA, PCR and genetic hybridization technologies (Entis and Lerner, 1991, RMR Labs, 2000, certification, Report, 2000; Klein and Juneja, 2001) have been developed.

Department of agriculture (USDA) and the Food and Drug Administration (FDA), are the two US agencies that made use of different protocol for analysis of *Listeria Monocytogenes*.

The techniques for isolation of *Listeria Monocytogenes* involve two- stage enrichment, the pre-enrichment followed by enrichment and plating for isolation.

The enrichment procedures helps to keep the level of contaminating microorganisms to a reasonable numbers and allow multiplication of *Listeria Monocytogenes* to levels that are enough for detection of the organism. Half Fraser Broth and the University of Vermont broth (UVM) are examples of broths for the pre-enrichment procedures. They allow revival of injured *Listeria* cells. The Fraser broth is used with a selective Fraser broth supplement in enriching for the enrichment steps after the pre-enrichment and for detecting *Listeria*. Both the Fraser and Half Fraser Broth contain sodium phosphate and potassium phosphate which are buffering agents. The presence of ferric ions acts as an indicator since the bacteria produces 6, 7-dihydroxycoumarin that reacts with the ferric ions thus resulting in the blackening of the medium. Lithium chloride, nalidixic acid and acriflavine give the broth a higher concentration of salt and inhibit growth of enterococci.

However, it is only after 48 hours that there is blackening of the broth.

For plating, PALCAM, Oxford and Modified Oxford (MOX) are used as selective agars for isolation of *Listeria Monocytogenes*. Lithium chloride, polymyxin B sulphate and acriflavine HCl, present in the PALCAM medium Base and ceftazidime found in the PALCAM supplement ensure the selectivity of the medium. These elements suppress other bacteria present in food except *Listeria*.

For differentiation, the PALCAM medium provides esculin and mannitol.

Hydrolysis of esculin by *Listeria* causes production of 6, 7, dihydroxycoumarin, which reacts with the ferric ions that are present in the PALCAM medium to form blacken halos.

USDA method:

The USDA method involve a two- stage enrichment procedure with a 24-48 hours primary enrichment with UVM medium followed by a second enrichment phase with Fraser broth. Black colonies on the MOX plates show the presence of *Listeria Monocytogenes*.

FDA method:

This method involves 48 hour enrichment at 30°C in buffered *Listeria* Enrichment Broth (BLEB). Pre enrichment procedure is optional which is done 4 hours at 30°C prior to the addition of the selective supplements. After 24 hours to 48 hours the culture is streaked onto Oxford, PALCAM, Lithium chloride-phenyl ethanol moxalactant (LPM). After 24-48 hours at 30°C, black-halo colonies prove the presence of *Listeria*.

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ISO method:

The ISO method and the USDA method are alike with only the difference of using Half Fraser Broth for enrichment in the ISO method. The enrichment is done using Fraser Broth. On PALCAM or Oxford agar, the Listeria colonies are gray green with the black halo and black respectively.