

Emerging Pathogens In Milk And Milk Products

Dr. E. Nanu, Dean,

College of Veterinary & Animal Sciences, Kerala Agricultural University,
Mannuthy, P.O, Thrissur- 680651.

Emerging diseases include outbreaks of previously unknown diseases or known diseases whose incidence in humans has significantly increased in the past two decades. Re-emerging diseases are known diseases that have reappeared after a significant decline in incidence. New infectious diseases continue to evolve and "emerge." Changes in human demographics, behavior, land use, etc. are contributing to new disease emergence by changing transmission dynamics to bring people into closer and more frequent contact with pathogens. The emergence of a new pathogen is a multiple factorial event involving in most cases impacts from all parts of the somewhat common place used concept farm to fork. Most of the so called emerging pathogens have been about for a long time but favoured by changes in environmental factors and abilities to modify their activities according to external influences, they provide a history of success for the microbe on the expense of food safety and mankind. The emergence of a pathogen is in some cases easily explained by the simple fact that cultivation technique for their detection was not available. This was the case in the past but is equally relevant today. The answer to this challenge is important to improve the detection methods based upon molecular biology and culture independent methods. However the origin of most of the food borne diseases which has emerged over the last half century can be explained by analysing the elements of the food chain particular for the organism in question. Some of the emerging pathogens in milk and milk products are given below.

E. coli O157:H7

E. coli O157:H7 was first recognized as a human pathogen in 1982 when two outbreaks in the United States were associated with consumption of undercooked hamburgers from a fast-food restaurant chain. The pathogen has since emerged as a major cause of bloody and nonbloody diarrhea. In addition to causing bloody diarrhea, E. coli O157:H7 infection is the most common cause of the hemolytic uremic syndrome, the leading cause of acute kidney failure in children in the United States. The syndrome is associated with long-term complications; 3% to 5% of patients with hemolytic uremic syndrome die, and approximately 12% have sequelae including end stage renal disease, hypertension, and neurologic injury. Consumption of ground beef, lettuce, raw cider, raw milk, and untreated water have been implicated in outbreaks, and person-to-person transmission is well documented

Listeria monocytogenes

L. monocytogenes is unique among Gram-positive bacteria in that it possessed lipopolysaccharide, which served as an endotoxin. Infection by L. monocytogenes causes the disease listeriosis. The manifestations of listeriosis include septicemia, meningitis (or meningoencephalitis), encephalitis, corneal ulcer, pneumonia, and intrauterine or cervical infections in pregnant women, which may result in spontaneous abortion (2nd/3rd trimester) or stillbirth. Surviving neonates of Fetomaternal Listeriosis may suffer granulomatous infantisepsis - pyogenic granulomas distributed over the whole body, and may suffer from physical retardation. Influenza-like symptoms, including persistent fever, usually precede the onset of the aforementioned disorders. Gastrointestinal symptoms such as nausea, vomiting, and diarrhea may precede more serious forms of listeriosis or may be the only symptoms expressed. Gastrointestinal symptoms were epidemiologically associated with use of antacids or cimetidine. The onset time to serious forms of listeriosis is unknown but may range from a few days to three weeks. The onset time to gastrointestinal symptoms is unknown but probably exceeds 12 hours. This organism is found naturally in the environment. Consuming raw milk could lead to contracting this organism. It could cause symptoms like flu-like illnesses to meningitis. It may also cause abortion in pregnant women. It has a mortality rate of 30% of those who are infected. **(Pasteurisation destroys this organism)**

Helicobacter pylori

H.pylori is a cork-screw shaped Gram-negative microaerophilic bacterium which is found to be present in the stomach and duodenum and is the most common bacterial infection of man. Many of those carrying the bacterium have little or no symptoms & are apparently well, but all without exception have inflammation of the stomach lining, a condition which is called "gastritis". Gastritis is the underlying condition which eventually causes ulcers and other digestive complaints. If a person has had an H.pylori infection constantly for 20-30 years, it can lead to cancer of the stomach. This is the reason that the World Health Organisation's (WHO) International Agency for Research into Cancer (IARC) has classified H.pylori as a "Class- I-Carcinogen" i.e. in the same category as cigarette smoking is to cancer of the lung & respiratory tract. This organism may be transmitted through contaminated milk. Infection with the organism is a powerful predisposing factor to the development of stomach cancer. Treatment of clinical cases is expensive, and a correct diagnosis in humans requires a gastric biopsy. **(Pasteurisation destroys this organism)**

Campylobacter jejuni

The genus Campylobacter, (meaning 'twisted bacteria') first discovered in 1963 describes Gram-negative, spiral, microaerophilic bacteria. Motile, with either uni- or bi-polar flagella, the organisms have a characteristic spiral/corkscrew appearance and are oxidase-positive. This organism is found naturally in soil, water, and farm waste and in the digestive tract of animals. Campylobacter jejuni is now recognized as one of the main causes of bacterial foodborne disease in many developed countries. At least a dozen species of Campylobacter have been implicated in human disease, with C. jejuni and C. coli the most common. C. fetus is a cause of spontaneous abortions in cattle and sheep, as well as an opportunistic s in humans. Campylobacteriosis is an infection by campylobacter. The common routes of transmission are fecal-oral, person-to-person sexual contact, ingestion of contaminated food or water, and the eating of raw meat. It produces an inflammatory, sometimes bloody, diarrhea, periodontitis or dysentery syndrome, mostly including cramps, fever and pain. The infection is usually self-limiting and in most cases, symptomatic treatment by reposition of liquid and

MILK & MILK PRODUCTS

electrolyte replacement is enough in human infections. The use of antibiotics, on the other hand, is controversial. In recent years there have been reports of severe outbreaks of enteritis in the UK attributed to *Campylobacter jejuni*. In all cases consumption of unpasteurised milk was implicated. Symptoms are profuse diarrhoea (sometimes bloody), stomach cramps, nausea, dizziness and fever. **(Pasteurisation destroys this organism)**

Mycobacterium avium spp. paratuberculosis (MAP)

Mycobacterium avium ssp. *paratuberculosis* (**MAP**) is a gram-positive, acid-fast and facultative anaerobic, intracellular bacterium. It is a fastidious microorganism that requires the growth factor mycobactin J for in vitro growth. *Mycobacterium avium* ssp. *paratuberculosis* (MAP) is the causative agent of paratuberculosis, or Johne's disease, a chronic granulomatous enteritis that affects all ruminants worldwide. Since the isolation of MAP from intestinal tissue of human patients bearing Crohn's disease, there has been a debate on the possibility of this agent playing a role in the etiology of Crohn's disease. Milk could be the potential vehicle for transmission to humans. *Mycobacterium avium* ssp. *paratuberculosis* has already been detected in milk samples worldwide. MAP is likely to be present in most bulk milk. Public health concerns about the presence of MAP in milk and dairy products, as cheese, it is most interesting that the organism has been shown to some extent to survive the pasteurisation of milk.

Tick-borne encephalitis

It is a tick-borne viral infection of the central nervous system affecting humans as well as most other mammals. It is caused by the tick-borne encephalitis virus. The virus can infect the brain (encephalitis), the membrane that surrounds the brain and spinal cord (meningitis) or both (meningoencephalitis). It is transmitted by the bite of infected deer- or sheep ticks or (rarely) through the non-pasteurized milk of infected cows. Sexual transmission has been documented in mice with vertical transmission to progeny. Sexual transmission with humans has never been documented. Is a viral infection, followed by exposure to infected ticks, may result in mild or more severe symptoms of influenza type of illness. The virus can, besides being tick-borne, also be transmitted by consumption of contaminated raw goat, sheep and cow milk, and is thus a food-borne zoonotic disease.

Enterobacter sakazakii

Enterobacter sakazakii is a Gram-negative, rod-shaped pathogenic bacterium. It is a rare cause of invasive infection with historically high case fatality rates (40–80%) in infants. It can cause bacteraemia, meningitis and necrotising enterocolitis. Environmental low level contamination of the milk powder during processing is likely to be the source of the organism. *E. sakazakii* infection has been associated with the use of powdered infant formula, with some strains able to survive in a desiccated state for more than 2 years. Sepsis (bacteria in the blood), meningitis (inflammation of the lining of the brain), or necrotizing enterocolitis (severe intestinal infection) are common symptoms of *Enterobacter sakazakii* infection exhibited by infants. These can be accompanied by seizures, brain abscess, hydrocephalus, developmental delay, and death. Significant morbidity in the form of neurological deficits can result from infection, especially among those with bacterial meningitis and cerebritis. *E. sakazakii* has a higher thermal resistance in comparison to other members of the Enterobacteriaceae family which might explain their high prevalence in powdered and prepared formula milk, they survive the spray drying of the milk with hot air. Also high osmotolerance of the organism may be of importance for its survival. The technology of powdered milk production is one of the most critical parts in the prevention of the risk and breaking of the line of transmission.

Bacillus cereus

Bacillus cereus is an endemic, soil-dwelling, Gram-positive, rod-shaped, beta hemolytic bacterium. Some strains are harmful to humans and cause foodborne illness, while other strains can be beneficial as probiotics for animals. *B. cereus* bacteria are facultative anaerobes, and like other members of the genus *Bacillus* can produce protective endospores. *B. cereus* is responsible for a minority of foodborne illnesses (2–5%), causing severe nausea, vomiting and diarrhea. Generally speaking, *Bacillus* foodborne illnesses occur due to survival of the bacterial endospores when food is improperly cooked. This problem is compounded when food is then improperly refrigerated, allowing the endospores to germinate. Bacterial growth results in production of enterotoxins, one of which is highly resistant to heat and to pH between 2 and 11; ingestion leads to two types of illness, diarrheal and emetic (vomiting) syndrome. The diarrheal type is associated with a wide-range of foods, has an 8- to 16.5-hour incubation time and is associated with diarrhea and gastrointestinal pain. The emetic form is commonly caused by rice that is not cooked for a time and temperature sufficient to kill any spores present, then improperly refrigerated.

--oOo--