Milk Borne Disease

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Abstract

- Milk and milk products from domestic animals, which are potential infectious hazards, are made more so by modern milk production, because milk from thousands of animals is often pooled prior to bottling or before manufacturing derivative products.
- Thus, contaminated milk from 1 animal can result in a widespread problem. Pasteurization largely eliminates this hazard. Most disease transmission caused by contamination of the milk supply has been eliminated by hygienic production measures and pasteurization.

- However , contamination may occur after pasteurization(post pasteurization).
- Despite scientific opinion that pasteurized products are safer than raw ones and are equally nutritious segments of the population regard raw milk products as more nutritious and better tasting than pasteurized milk products.

Pasteurization

Pasteurization is the process of heating liquids or food to kill microorganisms(such as: *Brucella*, *campylobacter ,salmonella , mycobacterium bovis*, *listeria, E.coli O157:H7*) that can cause disease.

In addition to protecting and improving consumer health, its also can improve the quality and shelf life of food.

It was developed by Luis Pasteur in 1864, and it was practiced and commercialized in the late 1800s and 1900s.

https://www.youtube.com/watch?v=r0rCEBPgo5Q

Bacterial infections

1) Brucella:

Brucellosis is one classical example of milk-borne infection, *Brucella spp* being transmitted from **goats to humans** either through **direct contact** or **through the milk of the infected animal**, particularly since the appearance and taste of the milk are rarely affected by the presence of the bacteria.

Once transmitted to humans, *Brucella* is responsible for a type of granulomatous hepatitis or an acute febrile illness which can, at times, persist and progress to a chronically incapacitating disease with serious complications.

2) Coliforms:

Coliform contamination ranks high among the most common types of contamination in the dairy industry. Microorganisms such as *Escherichia coli*, Pseudomonas *aeruginosa*, *Citrobacter spp*, *Klebsiella spp* and *Proteus* mirabilis can multiply in the normal summer temperatures and hence unpasteurized milk has every chance of containing E coli.

3) Staphylococcus:

The mechanism behind **staphylococcal enterotoxin gastroenteritis** is the production of a heat-stable enterotoxin by certain strains of *Staphylococcus Aureus*.

Humans and dairy cows are the main carriers of this microbe, presenting mucosal or cutaneous lesions such as impetigo or cattle mastitis.

Therefore, either the udder of cattle or the hands of milkers can be responsible for passing on the bacteria to milk, and staphylococcal mastitis is known to be prevalent in India even nowadays, with an older study showing that staphylococci were isolated from 61.97% of the bacteriologically-positive samples, appearing to be the main etiological agents of bovine mastitis in India.

The **enterotoxin** is very resistant to heating and pasteurization, boiling of the milk for one hour leading to a decrease in the quantity of toxin but only autoclaving at 15 psi for 20 minutes being able to completely destroy the toxin. The sterilized milk needs to be refrigerated at 0°C to 4°C until further processing. Since *staphylococci* are known to grow well on saline media, the risk for contamination is higher with home-made salted cheeses.

Contamination of milk with group *A streptococci* may occur through **humans or animals** which act as **carriers** and the infection can sometimes be passed on to dairy cows, causing udder lesions. Group *B streptococci* represent another known cause of bovine mastitis.

4) Tuberculosis:

Tuberculosis is yet another disease which can be transmitted through **raw milk**.

Infected cattle seem to be the most frequent **source** of infection, although buffalos, goats, sheep and camels can also pass on the bacteria.

5) Shigella:

presented shigellosis seven hours after eating sour cream contaminated with *Shigella flexneri* from **employees** who had shigellosis. The same strain was isolated from all the patients connected to this outbreak.

6) Typhoid:

Typhoid and *paratyphoid* fever are generally recognized as food-borne and water-borne illnesses but milk-borne infections have also been reported. The source of infection is generally a **human carrier among dairy industry workers**. Pasteurization is the best way of destroying Salmonella typhi and *paratyphi*.

7) Bacillus Anthrax:

Another relatively rare milk-borne pathogen is *Bacillus Anthracis* , a Gram-positive, spore-forming rod which has been shown to pass into the milk when it is present in cattle in large amounts. The contaminated milk often has an altered appearance and is secreted in smaller amounts therefore yielding a relatively low chance of transmission to humans through consumption of milk from sick cattle.

The real risk is that of environmental contamination of milk or other food products from the discharges of infected animals.

A different type of microorganism is the etiologic agent of **Q fever**, formerly categorized as *rickettsia*.

Most human *Coxiella burnetii* infections are caused by inhalation of contaminated dust or aerosols, but consumption of contaminated milk has also been mentioned as transmission route.

Viral infections

1)In the pre-vaccination era, poliomyelitis outbreaks had debilitating consequences, infections with polioviruses being correlated with milk contamination.

2)Coxsackie viruses.

3) Some other agents which can potentially contaminate milk are **tick-borne encephalitis** viruses, found more often in the milk of sheep, goats and less often in cow milk.

This virus also resists LTLT procedures but it can be inactivated through HTST pasteurization.

4) Hepatitis viruses, particularly hepatitis A virus (HAV) and hepatitis E virus (HEV) can also contaminate milk and a relatively recent study has demonstrated that increased fat content of dairy products appears to contribute to the heat stability of HAV. Hepatitis B virus (HBV), or hepatitis C virus (HCV) pose less of a threat since they recognize parenteral transmission, without a fecal-oral route .

Fungal infections

A series of pathogenic fungi can infect the udder of the cow and hence be excreted in large amounts in the milk. Nocardia asteroides has been found to cause bovine mastitis, being excreted in milk for a period of several months.

This fungus survives even if the milk is treated at a temperature of 74°C for 15 seconds or at 64°C for 30 minutes, but complete destruction of the organism is possible when the milk is heated at 66°C for 30 minutes.

Parasitic infections

- Certain parasites such as Taenia spp or Toxoplasma gondii, can contaminate milk and be transmitted to humans.
- Other sources of infection include the environment of milk procurement, which is heavily controlled in industrialized farms.
- Soil contamination may also lead to the presence of soil-borne parasites in milk (e.g., Ascaris lumbricoides, Trichuris trichiura). Hence sanitary conditions, proper pasteurization and hygienic conditions should be maintained to avoid such contaminations.

Prevent infections

- Apart from individual measures for preventing milk-borne infections, such as: only consuming milk which comes from trustful sources and has undergone the standard pasteurization techniques; avoiding home-made cheeses, creams, yoghurts; respecting the cold-chain for milk-based products, etc, in order to avoid bacterial, viral, fungal or parasitic contamination of milk, there are a series of measures enforced in the dairy industry. For example, testing for any clinical infections or open wounds is required in milkers, workers who come in direct or indirect contact with the milk. The personnel is also required to wear face masks and hair covers and to use hand sanitizers every half hour or at regular intervals.

- The facilities, such as milking sheds, silos, ice bank tanks where milk is stored, tankers used for transportation, milk processing plants, collecting tanks, pasteurizers, homogenizers, packing machines, packing materials, crates in which the milk sachets are transported should all be clean and periodically evaluated according to microbial counts per area, as prescribed by the governing bodies. All tanks, crates, silos, etc are regularly sanitized using hot water, caustic hot water, detergents or nitric acid solution. The silos and collection tanks are specifically cleaned according to Cleaning in Place (CIP) procedures, through a succession of hot water (80°C), caustic water and nitric acid solution at 65°C.

- The large insulated storage rooms are sterilized by fumigation using potassium permanganate and formaldehyde. Linear low-density polyethylene (LLDPE), high-density polyethylene (HDPE) and other types of food grade plastic used for packing undergo ultraviolet sterilization.
- Milk also undergoes microbial testing, organoleptic tests and a series of other biochemical tests (clot on boiling, phosphatase test, methylene blue reduction time test, milk adulteration test.