



Mastitis Milk



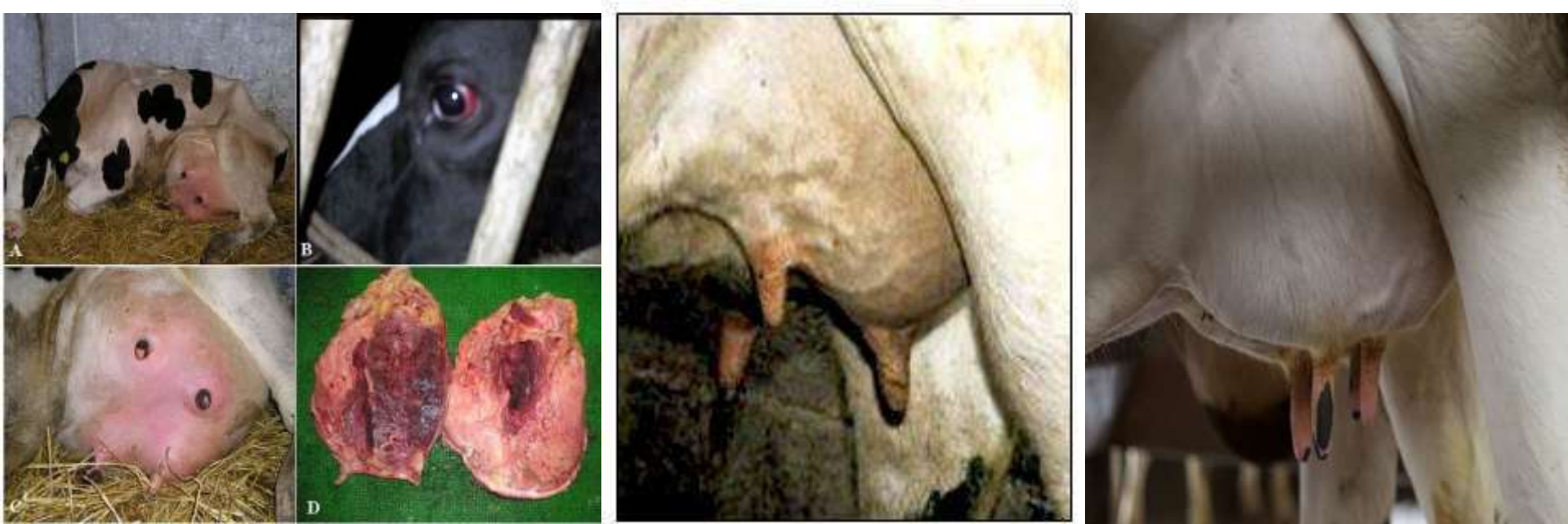
Mastitis is a parenchymal inflammation of the mammary gland that is caused by microbes that invade udder, multiply and produce toxins, which are harmful to mammary gland.



Classification based on symptoms

Swollen, hot, red and painful udders.

- **Acute or clinical:** Macroscopic changes to udder or milk, readily detectable by milker.
- **Chronic:** Little compositional changes with almost complete absence of pain in udder.
- **Sub-acute/ sub-clinical:** Most common form, udder and milk appear normal. Diagnosed by detecting pathogens and somatic cells and change in milk composition.



Causative Microorganisms

Causative microbes enter through teat tip into the teat duct, where these get colonized due to the presence of left over milk and subsequently, spread throughout the udder causing infection.

Microorganisms associated with mastitis:

- **Most common causatives are *Staphylococcus aureus* and *Streptococcus agalactiae*.**
- **Coliforms : *Escherichia coli*, *Enterobacter***
- **Other Streptococci: *Streptococcus uberis*, *Streptococcus dysgalactiae* and *Streptococcus pyogenes*.**
- **Corynebacteria: *C. bovis***
- **Yeast: *Candida pseudotropicalis***
- **Molds: *Aspergillus spp.***

Classification based on causative microorganisms

Contagious mastitis: *Streptococcus agalactiae* (as natural inhabitant of udder)

Common mastitis: Species of *Streptococcus*, *Staphylococcus* and *Escherichia coli*

Summer mastitis: *Corynebacterium pyogenes*

Environmental mastitis: *Streptococcus uberis*



Compositional Changes in Mastitic Milk

- Initial increased level of pathogenic bacteria occurs, which is closely followed by considerable increase in somatic cell count.
- Impaired synthetic ability of the secretory tissue causing lower milk yield and altered levels of major and minor milk constituents and increased infiltration of blood constituents i.e. serum proteins into milk.

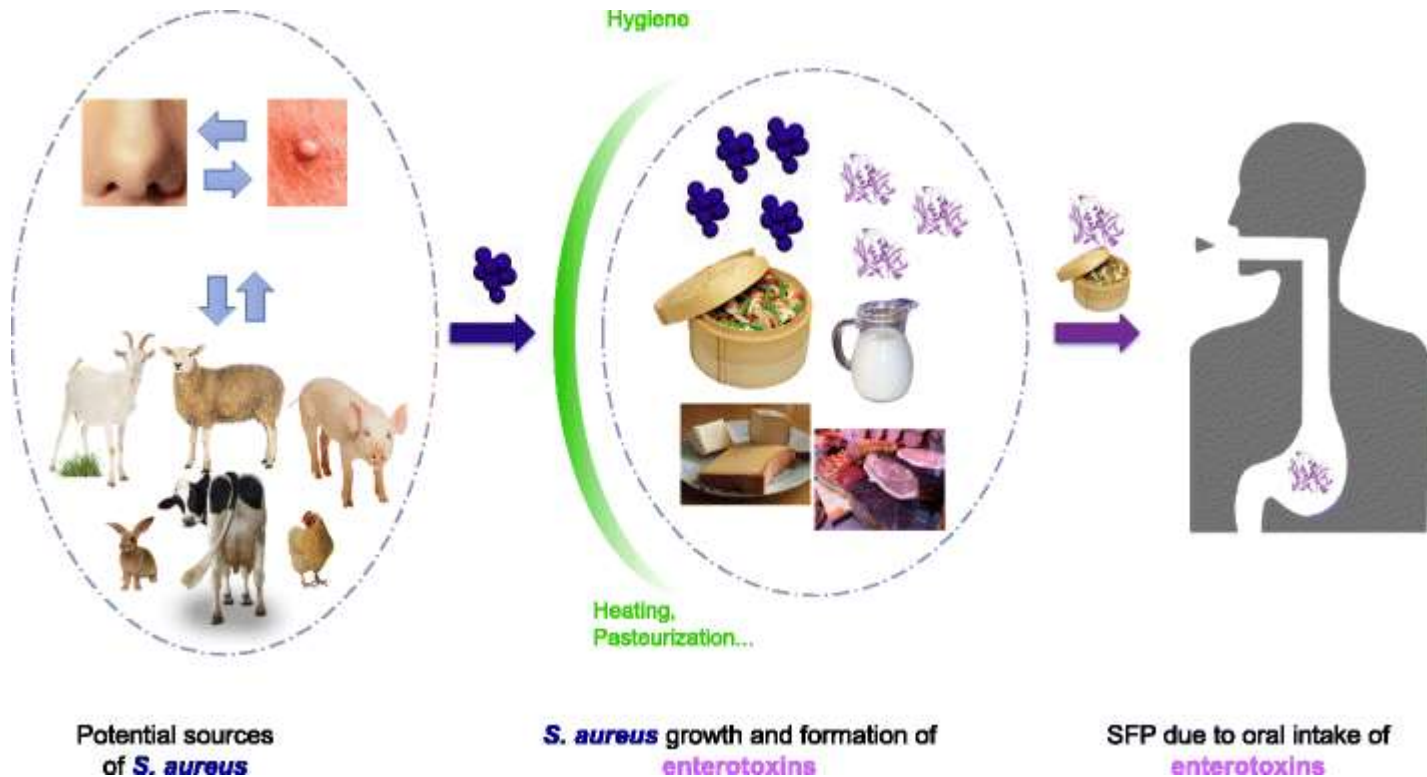
Increased constituents: **Whey proteins (bovine serum albumin, immunoglobulins), pH, sodium, chloride and other ions like Cu, Fe, Zn, various enzymes increase in mastitic milk.**

Decreased constituents: **Lactose, fat, total casein (α and β fractions) decrease but gamma fraction increase, whey proteins (α -lactalbumin and β -globulin), potassium, calcium, magnesium and phosphorus decrease.**

Constituent(s)	Normal	Mastitic
Fat (%)	3.45	3.2
Protein (%)	3.61	3.56
Lactose (%)	4.5 to 5.3	3.3-4.9
Bovine serum albumin (mg/ml)	0.82 to 1.29	4.3-21.5
Lactoferrin (mg/ml)	0.1 to 0.2	6.2
Sodium (mg/100ml)	57.0	104.6
Potassium (mg/100ml)	172.5	157.3
Chloride (mg/100ml)	80 to 103	7250
pH	6.65	6.9-7.0
Somatic cell ($\times 10^2$ /ml)	20 to 1000	100-5000
Catalase ($\mu\text{M O}_2$ /min/ml)	0.08	1.84
Lactic dehydrogenase (milliunits/ml)	300 to 500	Up to 5525
Alkaline phosphatase (units/ml)	191	712
Acid phosphatase (μM /ml)	0.063	0.081
Lysozyme (μg /ml)	0.0	5.6

Significance of Mastitic Milk

- In severe clinical mastitis, abnormalities of milk are easily observed and milk is discarded. Sub-clinical mastitic milk can enter food chain.
- Milk and other dairy products are frequently infected with *S. aureus*. Certain *S. aureus* strains produce heat-resistant enterotoxins that cause nausea, vomiting and abdominal cramps, when ingested by humans and are responsible for staphylococcal food poisoning.



- ***S. agalactiae*, an important bovine pathogen cause both clinical and sub-clinical mastitis in dairy animals.**
- **Mastitis constitutes a source of economic loss for the dairy industry.**
- **Reduces nutritive value of milk due to change in its composition, increase processing problems and off-flavours.**
- **Decreases shelf-life of fluid milk products.**
- **Another public health concern regarding mastitis is antibiotic residues in milk. Antibiotic residues can lead to severe reactions in people allergic to antibiotics and development of antibiotic-resistant strains of bacteria.**

- **Milk yield:** Milk yield and productive life of milch animal are adversely affected due to mastitis.
- **Milk quality:** Quality of milk is lowered due to compositional changes.
- **Suitability for fermented dairy products:** In cheese making, lower product yield which might be due to increased fat losses in whey and reduced starter activity.
- **Other fermented products:** Mastitic milk is not suitable for preparing fermented milks like dahi, yoghurt, kefir etc. where product quality is directly dependent on starter cultures. Rate of acid production attained in mastitic milk is lower than that in normal milk.

Public health significance

- ❖ **Staphylococci** associated with mastitic milk cause food poisoning due to enterotoxin production.
- ❖ Other pathogens and food poisoning causing bacteria like ***Salmonella spp.*** and enteropathogenic strains of certain coliforms (***E. coli*** and ***Klebsiella spp.***) might also be associated with public health hazards through mastitic milk.