

Milk to Man

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Introduction

Milk is the mammary secretion obtained from various farm animals for direct consumption or as processed form by human to get nutrients through it. Raw milk is defined as temperature of milk when less than 40°C without any heat treatment which can harbor zoonotic pathogens and toxins even though it is having some beneficial bacteria, prevention of lactose intolerance. India with the world's largest milk producer with 198.7 million tons of milk produced in 2019-2020 with the growth rate of 5.68% and per capita availability 406 grams per day against ICMR recommendations of 280 grams per day. According to EFSA, the major milk transmitting pathogens in milk especially during mastitis were *E. coli*, *Campylobacter* spp., *Salmonella* spp., *Bacillus cereus*, *Brucella abortus*, *Brucella melitensis*, *Listeria*, *Mycobacterium*, *Staphylococcus*, *streptococcus* (ESFA, 2015) and parasites toxoplasma gondii, cryptosporidium parvum. Young children, the elderly, pregnant women, immunocompromised (YOPI) people, and those who are ill should be aware of the dangers of drinking raw milk and raw milk products (Brom *et al.*, 2020)

Common milk organisms and diseases

Biggest concern with the dairy farms and storage facilities developed in India lies with the milk safety and milk quality where the contamination occurs at any stage of milk handling from animal to human consumption. Major aspects lie with milk safety is milker's hygiene, animal hygiene, environmental hygiene, milk handling and chemical residue in milk.

Singh *et al.* (2020) conducted a study in Punjab with about 300 farmers and found out that 24% of milk samples have contamination with *E. coli* samples, 5% samples with water adulteration and 3% samples with urea adulteration. Bhatt *et al.* (2011) in his study in Gujarat by milk metagenomic profiling by pyrosequencing of Kankrej, Gir and crossbred cattle found that mastitis milk have high *enterobacteriales* predominance followed by *pseudomonadales*, *bacillales*, *lactobacillales*. The most common bacteria detected in Kankrej and Gir cattle were

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Escherichia coli, *Pseudomonas aeruginosa*, *Pseudomonas medicina*, *Shigella flexneri* and *Bacillus cereus*. In crossbred cattle, *Staphylococcus aureus* was found first, followed by *Klebsiella pneumoniae*, *Staphylococcus epidermidis*, and *E. coli*. Joseph and Kalyanikutty (2021) examined 42 samples of raw milk from household vendors and cooperative milk marketing agencies and found prevalence of Shiga-toxicogenic *E. coli* (STEC) with multidrug resistance genes against penicillin, cefalexin, rifampicin, methicillin and novobiocin with potential public health threats like hemorrhagic colitis, hemolytic uremic syndrome.

E. coli also a gram-negative bacterium mostly by fecal contamination due to poor hygiene causes diarrhea mostly young ones, hemorrhagic colitis, hemolytic uremic syndrome and in extreme cases seems fatal. These are usually shed in ruminant faeces, which the animal defaecating while milking is major concern of pathogen transmission through milk (Martín and Beutín, 2011). Coliform are more susceptible at high temperature short time pasteurization (72°C for 15 seconds)

Staphylococcus aureus an important opportunistic pathogen which is a most common pathogen for mastitis, causing major economic loss to farmers. Staphylococcus are most common in skin commensals cause endotoxin release that affect humans by causing food poison with symptoms of vomiting, diarrhea within 2-6 hours and some staphylococci are becoming resistance to antibiotics called MSRA that pose risk to consumers due to over usage of antimicrobials.

Campylobacter, gram-negative bacteria mostly affect intestinal pathway leads to abdominal cramps, discomfort, diarrhea, fever and bloody stools with severe cases leads to nervous damage. They are environmental pathogen contaminated by faeces or direct excretion into milk. Effective pasteurization can control these microbes

Bacillus and *Clostridium* spp are environmental pathogens contaminate the milk by spore release, silage, feces, poor floor hygiene cause diarrhea by toxin release. Clostridium grown under anaerobic condition release two major type of toxin called neurotoxin, enterotoxin. Most famous zoonotic pathogen of milk transmission that can withstand high temperature and nowadays using as an indicator organism for milk pasteurization is *Coxiella burnetii* which cause Q-fever can infect wide range of species like ruminants, human leads to abortion. Some other zoonotic pathogens that excreted through milk is *Mycobacterium* spp. and Brucellosis which should be

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vaccinated at early ages of life to prevent them infection to humans through milk and screening for tuberculosis, brucellosis to be done for atleast once in year and the animal should be culled if presented positive. Tuberculosis can be screened by intradermal test and brucellosis by plate or tube agglutination test.

Brockmann *et al.*, 2016 in Germany encountered two human cases of tick born encephalitis transmitted by unpasteurized goat milk and cheese which was confirmed by serology analysis. TBE is caused by RNA virus of flavivirus genus which is transmitted by tick bite, shed through the milk and taken by oral route by humans.

Arena *et al.*, 2021 developed a bovine coronavirus immune milk (BIM) which confers passive immunity against SARS-CoV-2 infection as an immunostimulant therapy, that activate the intestinal immune system. This is possible due to the similar phylogenetic relationship between COVID-19 and BCoV viruses.

Conclusion

Major ill effects that transfer through milk comes from consumption of raw milk that too under unhygienic and under maintenance of environment, transport, processing and dispatch of milk. Hence, good farming and clean milk production, cold chain maintenance helps to reduce the environmental bacterial contamination. Recommendation of non-intake of raw milk especially by infants, pregnant women, elderly patients, immunocompromised persons.

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