MILK BORNE DISEASES OR ILLNESS:

A. Transmissible disease transmitted from infected man to another via contaminated milk either directly by infected or carrier individuals, or indirectly through polluted water, insects, air & dust, milk utensils & equipment, rodents, flies, rations, etc. like:

1) Salmonellosis.
   a) Typhoid fever caused by *Salmonella typhi*.
   b) Paratyphoid fever caused by *Salmonella paratyphi*.
   ✧ Sources of milk contamination:
       • Secreta and excreta (GIT) or hands of infected or carriers man.
       • Polluted water.
       • Flies.

2) Bacillary dysentery (Enterocolitis or Shigellosis) caused by:
   • *Shigella dysentery, Shigella shiga, Shigella sonnei & Shigella flexneriae*.
   ✧ Sources of contamination like Salmonellosis.

3) Diphtheria caused by *Corynebacterium diphtheriae*.
   ✧ Sources of contamination:
       • Infected or diseased personals.
       • Carriers.
       • Raw milk.
       • Teat sore.
       • Flies.
       • Contaminated equipment & utensils.

4) Septic sore throat plus otitis (Streptococcal pharyngitis).
   • *Streptococcus pyogenes* (Gram+ve cocci, β-haemolytic and catalase -ve).
     Sequels of this case in sever non-treated conditions either Streptococcal glomerulonephritis or rheumatoid fever.
   ✧ Sources of contamination:
       • Mastitis caused by infection of udder via infected handlers.
       • Secreta and excreta (saliva, sneezing, coughing, stool, urine, etc.) of infected or carriers handlers.
       • Indirectly via contaminated water, flies, soils, milk equipment, etc.

5) Scarlet fever (red rash) caused by *Streptococcus scarlatina*.
   ➢ Scarlet fever is a disease caused by bacterial pyrogenic exotoxin called erythrogenic toxin-A released by *Streptococcus pyogenes* or *scarlatina* leading to erythema or skin red rash. its common in 4-8 year old, usually spread via aerosol route (inhalation) or by skin contact or by fomites, incubation period is 1-4 days, asymptomatic carriers may occur in (15-20)% of school-age children, in severe cases the disease may complicate to glomerulonephritis, endocarditis with heart valve disorders and arthritis, all of which are fatal, thus we recommend to testing patient suffering from
chronic tonsillitis or arthritis with a serological antistreptococcal O-titer test (ASOT) to check antibody titer against Streptococcal infection.

Sources of milk contamination:
- Mastitis (directly).
- Carriers (indirectly).

6) Cholera caused by *Vibrio cholera* (rice water stool and dehydration).

Sources of milk contamination:
- Contaminated handlers (infected or carrier man).
- Indirectly via polluted water.
- Contaminated milk equipment.

7) Epidemic (infantile or summer) diarrhea.

- *Enteropathogenic Escherichia coli* (EPEC). Occurred in bottle fed babies causing watery stool, fever and diarrhea.

Sources of milk contamination:
- Animals manure.
- Flies and dust.

8) Cholera like syndrome.


9) Dysentery like syndrome.

- *Enteroinvasive Escherichia coli* (EIEC). Bloody mucous stool.

10) Hemorrhagic colitis.

- *Enterohemorrhagic Escherichia coli* (EHEC, especially type O157:H7). Colitis and bloody diarrhea.

- The disease is similar to infection with *Yersinia enterocolitis* and *Campylobacter jejuni*.

11) Human tuberculosis.

- *Mycobacterium tuberculosis* var *tuberculosis*.

Sources of milk contamination:
- Secreta and excreta of infected man is the main and major sources of infection as well as, contaminated raw milk, thus pasteurization eliminates these acid fast G+ve intracellular bacilli.

- Polymorph disease from pulmonary to GIT to renal tuberculosis cases.

- Prevention relies on screening programs and vaccination with the bacillus Calmette–Guérin vaccine (*BCG*).

- Antibiotic resistance is a growing problem in multiple drug-resistant tuberculosis (MDR-TB) infections.

- A chest X-ray and multiple sputum cultures for acid-fast bacilli are typically part of the initial evaluation, Interferon-γ release assays (IGRAs) may increase sensitivity when used in addition to the Mantoux tuberculin skin test. Rontogenographic screen or Computerized Axial Tomography (جهاز التصوير المقطعي المفراس) increase diagnosis of T.B.
12) Poliomyelitis caused by *Enteroviruses* type *polioviruses*.

- Polio or infantile paralysis, is an acute, viral, infectious disease spread from person to person, primarily via the fecal-oral route. Poliomyelitis denotes inflammation of spinal cord. This group of RNA viruses colonize the gastrointestinal tract — specifically the oropharynx and the intestine. The incubation time (to the first signs and symptoms) ranges from three to 35 days. The disease is transmitted primarily via the fecal-oral route, by ingesting contaminated food or water. Two types of vaccine are used throughout the world to combat polio. Both types induce immunity to polio, efficiently blocking person-to-person transmission of wild poliovirus, thereby protecting both individual vaccine recipients and the wider community (so-called herd immunity). The Salk vaccine, or inactivated poliovirus vaccine (IPV) and the Sabin vaccine, or live attenuated oral polio vaccine (OPV). Because OPV is inexpensive, easy to administer, and produces excellent immunity in the intestine (which helps prevent infection with wild virus in areas where it is endemic), it has been the vaccine of choice for controlling poliomyelitis in many countries. Licensed in 1962, it rapidly became the only polio vaccine used worldwide.

13) Infectious hepatitis caused by *Enteroviruses* type *hepatitis A viruses*.

- Icteric scalar or jaundice. Hepatitis A is an acute infectious disease of the liver caused by the hepatitis A virus (HAV), an RNA virus, usually spread by the fecal-oral route and infections often occur in conditions of poor sanitation and overcrowding, transmitted person-to-person by ingestion of contaminated food or water or through direct contact with an infectious person. Tens of millions of individuals worldwide are estimated to become infected with HAV each year. The time between infection and the appearance of the symptoms (the incubation period) is between two and six weeks and the average incubation period is 28 days. In developing countries, and in regions with poor hygiene standards, the incidence of infection with this virus is high and the illness is usually contracted in early childhood. Jaundice, a yellowing of the skin or whites of the eyes due to hyperbilirubinemia. Bile is removed from blood stream and excreted in urine, giving it a dark amber colour.

14) Amoebic dysentery caused by *Entamoeba histolytica*.

- Bloody mucous dysentery. Amoebic dysentery is transmitted through contaminated food and water. Amoebae spread by forming infective cysts which can be found in stools, and spread if whoever touches them does not sanitize their hands. There are also free amoebae, or trophozoites, that do not form cysts, however trophozoites do not survive long outside of the human gastrointestinal tract, and are a purely diagnostic observation. Trophozoites are the agent responsible for symptoms. Amoebic dysentery is most common in developing countries.
Dysentery (formerly known as flux or the bloody flux) is an inflammatory disorder of the intestine, especially of the colon, that results in severe diarrhea containing blood and mucus in the feces with fever, abdominal pain, and rectal tenesmus (a feeling of incomplete defecation), caused by any kind of infection. Dysentery results from viral infections, bacterial infections, or parasitic infestations. These pathogens typically reach the large intestine after entering orally, through ingestion of contaminated food or water, oral contact with contaminated objects or hands, and so on. Dysentery is initially managed by maintaining fluid intake using oral rehydration therapy, it may be necessary to administer a combination of drugs, including an amoebicidal drug to kill the parasite and an antibiotic to treat any associated bacterial infection.

B. Zoonotic disease transmitted from infected animals to healthy individuals (man) by contaminated milk either directly from diseased or infected dairy cattle or indirectly via polluted water, flies, dust, contaminated milk equipment, etc. like:

1) Bovine tuberculosis.
   - *Mycobacterium tuberculosis var bovis*.
   - The main source of infection is the consumption of raw unpasteurized milk.
   - Two types for transmission through milk either directly via tuberculous mastitis forms (acute caseating, chronic nodular and chronic diffuse granulomatous) or indirectly via tuberculous enteritis, hepatitis, nephritis and pulmonary type; and by both ways (directly & indirectly) by generalized or miliary or disseminated tuberculosis (Its name comes from a distinctive pattern seen on a chest X-ray of many tiny spots distributed throughout the lung fields with the appearance similar to millet seeds—thus the term "miliary" tuberculosis). Miliary TB may infect any number of organs, including the lungs, liver, and spleen. It is a complication of 1–3% of all TB cases.
   - Controlling procedures including test and slaughter in dairy farms, i.e., tuberculin test in suspected animals (0.1 ml ppd in caudal or anal fold), so we vaccinate –ve reactors and slaughtering +ve reactors with postmortem examinations; Mantoux tuberculin test in man (dairy workers) with X-ray or tomographic screen and cultural method especially from sputum; and sufficient thermal processing of milk in time and temperature (pasteurization), boiling and sterilization will eliminate tuberculous bacilli.

2) Brucellosis (contagious abortion, undulant or Malta or Mediterranean Sea fever).
   - *Brucella abortus* and *Brucella melitensis*.
   - *Erythritol* is the main alcoholic sugar for activity and viability of these G-ve intracellular coccobacilli, found in gravid uterus.

- Sources of contamination ➔ Food ➔ GIT ➔ Blood ➔ supramammary and deep inguinal lymph nodes ➔ aborted fetus, placenta and uterine discharge.
Infection methods in man including orally by GIT and food, direct contact with infected personals or animals especially in farms, and by respiration and conjunctiva of eyes (mucous membranes).

Efficient heat processing like pasteurization or boiling or increase ripening of cheese (increased acid environment) will destroying these G-ve intracellular coccobacilli.

3) Anthrax (malignant carbuncle, wool sorter disease, splenic fever, Siberian ulcer, Charbon, Milzbrand).

- Bacillus anthracis.
- Anthrax is an acute notifiable disease caused by the bacterium Bacillus anthracis. Most forms of the disease are lethal, and it affects both humans and animals. There are effective vaccines against anthrax, and some forms of the disease respond well to antibiotic treatment. Bacillus anthracis can form dormant endospores that are able to survive in harsh conditions for decades or even centuries. Such spores can be found on all continents, even Antarctica. When spores are inhaled, ingested, or come into contact with a skin lesion on a host, they may become reactivated and multiply rapidly. The disease is more common in countries without widespread veterinary or human public health programs. Bacterial spores are soil-borne. Because of their long lifespan, spores are present globally and remain at the burial sites of animals killed by anthrax for many decades. Disturbed grave sites of infected animals have caused reinfection over 70 years after the animal's interment. Anthrax can enter the human body through the intestines (ingestion), lungs (inhalation), or skin (cutaneous) and causes distinct clinical symptoms based on its site of entry. In general, an infected human will be quarantined. Anthrax can be contracted in laboratory accidents or by handling infected animals or their wool or hides. It has also been used in biological warfare agents and by terrorists to intentionally infect as exemplified by the 2001 anthrax attacks. B.anthracis appears as medium-large, gray, flat, irregular with swirling projections, often referred to as "medusa head" appearance, and is non-hemolytic on 5% sheep blood agar. It is non-motile, is susceptible to penicillin and produces a wide zone of lecithinase on egg yolk agar. Confirmatory testing to identify B.anthracis includes gamma bacteriophage testing, indirect hemagglutination and enzyme linked immunosorbent assay to detect antibodies. Anthrax is also a Biphasic disease. Occupational exposure to infected animals or their products (such as skin, wool, and meat) is the usual pathway of exposure for humans. Workers who are exposed to dead animals and animal products are at the highest risk, especially in countries where anthrax is more common. The lethality of the anthrax disease owes itself to the bacterium's two principal virulence factors: (i) the poly-D-glutamic acid capsule, which protects the bacterium from phagocytosis by host neutrophils, and (ii) the tripartite protein toxin, called anthrax toxin. Anthrax toxin is a mixture of...
three protein components: (i) protective antigen (PA), (ii) edema factor (EF), and (iii) lethal factor (LF). Microscopic visualization of the encapsulated bacilli, usually in very large numbers, in a blood smear stained with polychrome methylene blue (McFadyean stain) is fully diagnostic, though culture of the organism is still the gold standard for diagnosis. The disease is often fatal in animals with rapid signs including septicemia, sudden death with uncoagulated tarry dark blood and bacilli may secreted into the milk before 48hrs from death. The disease has 4 forms: skin or cutaneous, GIT, respiratory and C.N.S. form. Ascoli test a thermo-precipitation for the diagnosis of anthrax using a tissue extract and anthrax antiserum, used for the detection of anthrax bacilli in animal’s hides and meat. Vaccines against anthrax for use in livestock and humans have had a prominent place in the history of medicine, from Pasteur’s pioneering 19th century work with cattle to the controversial 20th century use of a modern product (BioThrax) to protect American troops against the use of anthrax in biological warfare.

4) Q-fever (Question fever).
   - A rickettsia called Coxiella burnetii.
   - It’s a tick borne fever caused by infection with Coxiella burnetii, an obligate intracellular rickettsia pathogen. The infection results from inhalation of a spore-like small cell variant, and from contact with the milk, urine, feces, vaginal mucus, or semen of infected animals. The common way of infection is inhalation of contaminated dust, contact with contaminated milk, meat, wool and particularly birthing products. Ticks can transfer the pathogenic agent to other animals. Incubation period is usually two to three weeks.
   - Clinical signs in animals: Cattle, goats and sheep are most commonly infected, and can serve as a reservoir for the bacteria. Q fever is a well-recognized cause of abortions in ruminants and in pets. Infected animals may show respiratory signs such as pneumonia, but also abortion and infertility. Sever systemic signs such as anorexia and fever may occur. Infected animals may sheds huge quantities of this pathogen in raw milk especially after abortion or in mastitis cases as a high dangerous source for human infection either through ingestion or via aerosol (respiration). Signs and symptoms in man: the most common manifestation is mild flu-like symptoms with abrupt onset of fever, malaise, profuse perspiration, severe headache, myalgia (muscle pain), joint pain, loss of appetite, upper respiratory problems, dry cough, pleuritic pain, chills, confusion and gastrointestinal symptoms, such as nausea, vomiting and diarrhea. The fever lasts approximately seven to 14 days. During its course, the disease can progress to an atypical pneumonia, which can result in a life-threatening acute respiratory distress syndrome (ARDS). Protection is offered by Q-Vax, a whole-cell, inactivated vaccine developed by an Australian
vaccine manufacturing company, the intradermal vaccination is composed of killed *Coxiella burnetii* organisms.

5) **Listeriosis.**

- *Listeria monocytogenes* and *Listeria ivanovii*.
- Polymorphic disease from encephalomyelitis to abortion to unique food poisoning to skin lesions to etc.
- *Listeria monocytogenes* is ubiquitous G+ve motile bacteria in the environment. The main route of acquisition of *Listeria* is through the ingestion of contaminated food products. *L. monocytogenes* has been isolated from a variety of foods such as raw milk, pasteurized fluid milk, cheeses (particularly soft-ripened varieties), ice cream, raw vegetables, fruits, fermented raw-meat sausages, raw and cooked poultry, raw meats (of all types), raw and smoked fish, and seafood. Soft cheese, unpasteurized milk and unpasteurized pate are potential dangerous; however, some outbreaks involving post-pasteurized milk especially chocolate milk have been reported. Its ability to grow at temperatures as low as 0°C permits multiplication in refrigerated foods. At refrigeration temperature, such as 4°C, the amount of ferric iron can affect the growth of *L. monocytogenes*. It can grow and reproduce inside the host's cells and is one of the most virulent food-borne pathogens, with 20 to 30 percent of clinical infections resulting in death. Responsible for approximately 2,500 illnesses and 500 deaths in the United States (U.S.) annually, listeriosis is the leading cause of death among foodborne bacterial pathogens, with fatality rates exceeding even *Salmonella* and *Clostridium botulinum*. Studies suggest up to 10% of human gastrointestinal tracts may be colonized by *L. monocytogenes*. Invasive infection by *L. monocytogenes* causes the disease listeriosis. When the infection is not invasive, any illness as a consequence of infection is termed febrile gastroenteritis (food poisoning). Cutaneous type is rarely detected, and largely confined to veterinarians who are handling diseased animals, most often after a listerial abortion. The infective dose of *L. monocytogenes* varies with the strain and with the susceptibility of the victim. From cases contracted through raw or supposedly pasteurized milk, one may safely assume that, in susceptible persons, fewer than 1,000 total organisms may cause disease. *L. monocytogenes* may invade the gastrointestinal epithelium.

Once the bacterium enters the host's monocytes, macrophages, or polymorphonuclear leukocytes, it becomes blood-borne (septicemic) and can grow. Its presence intracellularly in phagocytic cells also permits access to the brain and probably transplacental migration to the fetus in pregnant women. A bacteriophage, *Listeria phage P100*, has been proposed as food additive designed to control and to kill *L. monocytogenes*. Uses would potentially include spraying it on fruits and ready-to-eat meat such as sliced ham and turkey.
6) Rabies.
   Rabies (From Latin: rabies, "madness") is a viral disease that causes acute encephalitis in warm-blooded animals (endotherms). The disease is zoonotic, meaning it can be transmitted from one species to another, such as from dogs to humans, commonly by a bite from an infected animal. For a human, rabies is almost invariably fatal if post exposure prophylaxis is not administered prior to the onset of severe symptoms. The rabies virus infects the central nervous system, ultimately causing disease in the brain and death. The rabies virus is a built-shape of the type species of the *Lyssavirus* genus, in the family *Rhabdoviridae*, order *Mononegavirales*. These viruses are enveloped and have a single-stranded RNA genome with negative sense. Cerebral inclusion bodies called Negri bodies are 100% diagnostic for rabies. Rabies has been called hydrophobia because victims, locally paralyzed and unable to swallow, have been known to become agitated at the sight of water. Once the rabies virus reaches the central nervous system and symptoms begin to show, the infection is virtually untreatable and usually fatal within days. Death almost invariably results 2 to 10 days after first symptoms. Early-stage symptoms of rabies are malaise, headache and fever, progressing to acute pain, violent movements, uncontrolled excitement, depression, and hydrophobia. Finally, the patient may experience periods of mania and lethargy, eventually leading to coma. The primary cause of death is usually respiratory insufficiency. Rabies has two forms obvious furious form and silent dormant form, the virus can live in lipid layer of bat without infection of it, and thus vampires represents the main source of infection.

7) Cow Pox.
   Cowpox is a skin disease caused by a virus known as the cowpox virus. The pox is related to the *vaccinia* virus and got its name from the distribution of the disease when dairymaids touched the udders of infected cows. The ailment manifests itself in the form of red blisters, and is transmitted by touch from infected animals to humans. Cowpox is similar to but much milder than the highly contagious and often deadly smallpox disease. It resembles mild smallpox, and was the basis of the first smallpox vaccines. When the patient recovers from cowpox, the person is immune to smallpox. It’s an orthopox with dsDNA type, causing red blisters or frayed egg lesions on skin or hands of farmers.
8) **Foot and Mouth disease (FMD).**

- Foot-and-mouth disease or hoof-and-mouth disease (*Aphthae epizooticae*) is an infectious and sometimes fatal viral disease that affects cloven-hoofed animals, including domestic and wild bovids. The virus causes a high fever for two or three days, followed by blisters inside the mouth and on the feet that may rupture and cause lameness. The virus responsible for the disease is a **picornavirus**, the prototypic member of the genus *Aphthovirus*. Infection occurs when the virus particle is taken into a cell of the host. The cell is then forced to manufacture thousands of copies of the virus, and eventually bursts, releasing the new particles in the blood. The virus is genetically highly variable, which limits the effectiveness of vaccination. Foot-and-mouth disease (FMD) is a severe plague for animal farming, since it is highly infectious and can be spread by infected animals through aerosols, through contact with contaminated farming equipment, vehicles, clothing or feed, and by domestic and wild predators. Its containment demands considerable efforts in vaccination, strict monitoring, trade restrictions and quarantines, and occasionally the elimination of millions of animals. Because the virus that causes FMD is sensitive to stomach acid, it cannot spread to humans via consumption of infected meat, except in the mouth before the meat is swallowed.

- **Pasteurization:** is a process of heating a food, which is usually a liquid, to a specific temperature for a predefined length of time with a pressure and then immediately cooling it after it is removed from the heat. This process slows spoilage caused by microbial growth in the food. Unlike sterilization, pasteurization is not intended to kill all micro-organisms in the food. Instead, it aims to reduce the number of viable pathogens so they are unlikely to cause disease (assuming the pasteurized product is stored as indicated and is consumed before its expiration date). Commercial-scale sterilization of food is not common because it adversely affects the taste and quality of the product. Certain foods, such as dairy products, may be superheated to ensure pathogenic microbes are destroyed. Milk is an excellent medium for microbial growth, and when stored at ambient temperature bacteria and other pathogens soon proliferate. Pasteurization found to kill 3 major milk borne pathogens: *Mycobacterium tuberculosis*, *Brucella spp.* and *Coxiella burnetii*. 