

## Review Article

# Brucellosis and Its Control through One Health Approaches in Ethiopia

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## Abstract

Brucellosis also known as “undulant fever”, “Mediterranean fever” or “Malta fever” is a highly contagious zoonosis caused by ingestion of unpasteurized milk or undercooked meat from infected animals, or close contact with their secretions. Brucellosis has been an emerging disease since the discovery of *Brucella melitensis* by Bruce in 1887. Subsequently, an increasingly complex pattern of strains has emerged with the identification of *Brucella abortus*, *Brucella suis*, *Brucella neotomae*, *Brucella ovis*, *Brucella canis*, and, more recently, types infecting marine mammals. Because each type has distinctive epidemiologic features, with each new type, the complexity of the interaction with humans has increased. Because new strains may emerge and existing types adapt to changing social and agricultural practices, the picture remains incomplete. The disease is presented as an acute or persistent febrile illness with a diversity of clinical manifestations. Treatment of the disease is difficult because its symptom is complex, it can cause flu and malaria like symptoms. So it causes much economic destruction by direct and indirect. The control of brucellosis requires collaboration of different discipline through one health approach. Especially, in developing country Ethiopia, since the eradication of brucellosis is difficult, its control is very important.

## INTRODUCTION

*Brucella* spp are gram-negative, strictly aerobic, non motile, coccobacilli or small rods. They are facultative intracellular parasites that are taxonomically categorized in the class  $\alpha$ -Proteobacteria, order Rhizobiales, family Brucellaceae. They produce oxidase, catalase, nitrate reductase, and urease (except *Brucella ovis*); fail to produce indole; are nonhemolytic; do not liquefy gelatin; and have negative methyl red and Voges-Proskauer tests. Most (again except *B. ovis*); utilize glucose as an energy source. *Brucella* spp. have been classified as potential agents of bioterrorism because they may be spread by aerosol and there are no human vaccines [1].

Ethiopia is one of the sub-Saharan African countries, with the largest animal and second largest human population. Livestock are the major sources of income and security for a significant segment of the population, and the system of animal production is by and large of an extensive type [2]. Brucellosis creates a serious economic problem for the intensive and extensive livestock production systems. Losses in animal production due to this disease can be of major importance primarily because of 20% decreased milk production in aborting cows. The common sequel of infertility increases the period between lactations. The average inter calving period of an infected herd prolonged

by several months. In addition, it results in loss of calves and interference with the breeding program. This is of the greatest importance in beef herds, where the calves represent the sole source of income. A high incidence of permanent infertility. The relationship between humans and animals is so close, and the perception of the general population as regards risky practices that favor pathogen transmission is low. Although brucellosis has been reported to be endemic the global burden of human brucellosis remains enormous: The infection causes more than 500,000 infections per year worldwide.

Symptoms usually appear within five to 30 days after you come in contact with the bacteria. General symptoms of brucellosis are often vague and similar to the flu. They may include: Fever (the most common symptom, with high “spikes” that usually occur in the afternoon), Back pain, Body-wide aches and pains, Poor appetite and weight loss, Headache, Night sweats, Weakness, Abdominal pain, Cough. Those symptoms may confuse with malaria especially in sub-Saharan Africa. Thus result in miss use of drug and development of complicated brucellosis. So before occurrence of brucellosis in both animals and humans, what require is to control and prevent it. This paper is give sights how control brucellosis through one health approach in Ethiopia.

## Brucellosis in animals and human

**Etiology:** Brucellosis is a sub-acute or chronic disease which may affect many species of animals. In cattle, sheep, goats, other ruminants and pigs the initial phase following infection is often not apparent. In sexually mature animals the infection localizes in the reproductive system and typically produces placentitis followed by abortion in the pregnant female, usually during the last third of pregnancy, and epididymitis and orchitis in the male.

Most species of *Brucella* are maintained in a limited number of reservoir hosts. Maintenance hosts for *Brucella abortus* include cattle, bison (*Bison* spp.) water buffalo (*Bubalus bubalus*), African buffalo (*Syncerus caffer*), elk and camels. A feral pig population was recently reported to maintain *B. abortus* in the U.S. Sheep and goats are the reservoir hosts for *B. melitensis*. Sheep are also the maintenance hosts for *B. ovis*. In addition, *B. ovis* occurs in farmed red deer (*Odocoileus virginianus*) in New Zealand. *B. canis* maintained in dogs and *B. neotomae* in rodents. *B. suis* contains more diverse isolates than other *Brucella* species, and these isolates have broader host specificity. *B. suis* biovars 1, 2 and 3 affect swine. Biovars 1 and 3 are found in both domesticated pigs (*Sus scrofa domesticus*) and wild or feral pigs. Biovar 2 currently occurs mainly in wild boar (*Sus scrofa scrofa*) and European hares (*Lepus capensis*); however, this biovar can be transmitted from these reservoirs to domesticated pigs, and spreads readily in these herds. Biovar 4 is maintained in caribou and reindeer (*Rangifer tarandus* and its various subspecies). Biovar 5 is found in small rodents. Marine *Brucella* species have been found by culture or serology in many pinniped and cetacean species including seals, sea lions, walruses, porpoises, dolphins, whales and a European otter. Other species can become accidental hosts, particularly after close contact. *B. abortus*, *B. melitensis* and *B. suis* infections are reported occasionally in many species including horses, cattle, sheep, goats, camels, pigs, moose, chamois, alpine ibex, raccoons, opossums, dogs, coyotes, foxes and wolves. Experimental infections with marine mammal isolates have been described in cattle, sheep and guinea pigs, and unpublished experiments suggest that piglets can be infected transiently. In contrast, *B. ovis* and *B. canis* seem to be relatively host specific. Experimental *B. ovis* infections have been reported in goats and cattle, but there is no evidence that these species are infected in nature. Dogs are the only species known to be naturally infected with *B. canis*, although antibodies to this organism have been found in other carnivores. Experimental *B. canis* infections can be established in domesticated livestock and chimpanzees; however, these species are considered highly resistant to natural

exposure [3] (Table 1).

**Epidemiology of brucellosis:** Brucellosis occurs worldwide and remains endemic among Mediterranean countries of Europe, Northern and Eastern Africa, Near East countries, India, Central Asia, Mexico and Central and South America (FAO, 2003). It is more prevalent in developing countries and considered to be a serious health problem due to lack of effective public health measures, domestic animal health programs, and appropriate diagnostic facilities. Furthermore, the situation is also worsened by the resemblance of the disease with other diseases leading to misdiagnosis and underreporting [4]. Also it is considered as a re-emerging problem in many countries such as Israel, Kuwait, Saudi Arabia, Brazil and Colombia, where there is an increasing incidence of *Brucella melitensis* or *Brucella suis* biovar1 infection in cattle [5]. In Ethiopia, brucellosis is endemic and the disease is highly prevalent in cattle, camels and small ruminants in pastoral and agro-pastoral areas. Despite endemic nature of brucellosis in many developing countries the disease remains under diagnosed and under-reported [6]. Most research work on brucellosis has been focused on intensive dairy cattle herds in urban and peri-urban areas. In 1987, the World Organisation for Animal Health (OIE) reported a prevalence of 20%; the prevalence was higher around large towns than in rural areas. In zebu cattle of the central highlands, [7] reported a prevalence of 4.2%. [8] found a prevalence of 10% in Addis Ababa, and in a study conducted on smallholder farms of central Ethiopia (the Wuchale-Jida district), [9] reported a prevalence of 11%.

In Ethiopia, 95% of cattle are farmed under extensive systems. Extensive farming most commonly refers to sheep and cattle farming in areas with low agricultural productivity, like boran. According to the available data, *Brucella* sero prevalence within extensive cattle rearing systems is lower than that of intensive systems. [10] reported overall individual animal prevalence and herd prevalence of 0.77 and 2.9%, respectively in Jimma Zone. Recent reports from North West, Tigray region [11] and Southern Sidama Zone [12], recorded an overall prevalence of 1.2 and 1.66% following screening 848 and 1627 cattle from extensive system, respectively.

**Transmission:** Brucellas are usually spread through contact with infected birthing tissues and fluids (e.g., placenta, aborted fetuses, fetal fluids, vaginal discharges) (<http://www.cfsph.iastate.edu>). The bacteria can also be found in the milk, blood, urine and semen of infected animals. In animals, natural transmission occurs by ingestion of organisms, which are

**Table 1:** The table below summarizes *Brucella* strains, hosts and transmission mode (<http://www.ansci.wisc.edu>, 2002).

Strain	Principle Host	Other Hosts	Symptoms	Transmission	Human Disease
<i>B. abortus</i>	Cattle	sheep, goats, pigs, horses, dogs, humans, wild ungulates	Abortion after 5 months	Ingestion, some venereal	undulant fever-control with antibiotics
<i>B. melitensis</i>	sheep, goats, buffalo	cattle, pigs, dogs, humans, camels	Later term abortion, weak young, mastitis (goats)	Ingestion	Malta fever: can be fatal in humans
<i>B. ovis</i>	sheep		most often effects rams, rare abortions		
<i>B. suis</i>	pig	catle, horses dogs, humans reindeer, caribou	abortion, infertility	ingestion and venereal	extremely deadly in humans
<i>B. canis</i>	dogs	humans	abortions at 40-60 days	venereal	mild disease in humans

present in large numbers in aborted fetuses, fetal membranes, and uterine discharges. Cattle may ingest contaminated feed and water or may lick contaminated genitals of other animals. Venereal transmission by infected bulls to susceptible cows appears to be rare. Transmission may occur by artificial insemination when *Brucella*-contaminated semen is deposited in the uterus but, reportedly, not when deposited in the mid cervix. *Brucellae* may enter the body through mucous membranes, conjunctivae, wounds, or intact skin in both people and animals (<http://www.merckvetmanual.com>). In human, *Brucellosis* is spread through contact with blood, body tissues, or body fluids of infected animals. The most common method is consumption of unpasteurized milk and dairy products. Human infections may occur through breaks in the skin when handling infected animal tissues (<http://dhss.delaware.gov>).

### Risk factors

**Risk factors associated to bacteria:** *Brucella* is intracellular pathogen which is able to survive and replicate within phagocytic cells. It can persist on fetal tissues and soil or vegetation for 21-81 days depending on month, temperature, and exposure to sunlight. Bacteria purposely applied to fetal tissues persisted longer in February than May and did not survive on tissues beyond 10 June regardless of when they were set out. *Brucella abortus* field strain persisted up to 43 days on soil and vegetation at naturally contaminated bison birth or abortion sites. Fetuses were scavenged by a variety of birds and mammals in areas near YNP and more rapidly inside YNP than outside the Park boundary [13]. *Brucella* bacteria also can survive in cold area and frozen meat for long period of time. It have been recovered from fetuses and from manure that has remained in a cool environment for > 2 mo. *Brucella* is sensitive to direct sun light, disinfectant and pasteurization. The congregation of a large number of mixed ruminants at water points facilitates disease spread [14]. *Brucella abortus* is the aetiological agent of bovine brucellosis and affects other species such as bison, buffalo or elks. *Brucella melitensis* can affect most domestic animals, but dairy sheep and goats are especially susceptible representing an important risk for the maintenance of the agent in the animal population with special importance in areas where wildlife and cattle rearing occur together.

**Risk factor of the host:** The host factors, which are associated with spread of the disease brucellosis within a herd, include unvaccinated animals in infected herds, herd size, population density, age, sexual maturity and use of maternity pens and close living with wild animals.

**Occupations at higher risk:** People who work with animals or come into contact with infected blood are at higher risk of brucellosis. Examples include: Veterinarians, Dairy farmers, Ranchers, Slaughterhouse workers, Hunters, Microbiologists and farmers.

### Prevention and control of brucellosis through one health approach

A very important approach to the control of brucellosis that is gaining more and more recognition around the world in recent years is the One Health approach to control and prevent human

and animal brucellosis requires multidiscipline efforts since neither veterinarian alone nor physician alone couldn't perform all approaches of control. So it requires participation of other discipline and farmers for effective control especial in developing countries where most people are live closer to animals.

In the One Health framework veterinary, medical, environmental and allied professionals and experts collaborate together with the aim of identifying possible risk factors for this infection and design a suitable approach to combatting the infection. Unfortunately, in many underdeveloped and developing countries, this kind of collaboration is non-existent or weak which gives room for brucellosis to thrive unchecked especially in rural populations. Everybody has responsible to keep the health of his or her own health environment and animals including farmers.

Methods of prevention include health education to reduce occupational and food-borne risks, including pasteurization of all dairy products. However, education campaigns have never resulted in fully eliminating the risks of infection, and the ultimate prevention of human infection remains elimination of the infection among animals. This can be achieved by a combination of vaccination of all breeding animals to reduce the risks of abortion and raise herd immunity, followed by elimination of infected animals or herds by segregation and slaughter. Since an infectious, contagious and world wide spread form of an important zoonotic disease that causes direct and direct economic deterioration. Particularly in developing countries where the animals are most economic source, it requires collaboration of society to control it.

In Ethiopia at regional levels, no strategy is in place to control brucellosis [15]. But everybody has own responsibility to keep his environment, animals and own health care. To lower your risk of getting brucellosis from a natural source: Avoid eating or drinking unpasteurized milk, cheese, or ice cream (including queso fresco). Check the label to make sure it says "pasteurized" and don't eat it if you aren't sure, do not handle sick or dead animal bodies, But if you must, then use gloves plus face and eye protection, cook meat thoroughly, It is always a good idea to wash your hands regularly and avoid touching your eyes, nose, and mouth and disinfecting of the area where the animals are aborted.

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