

Review article

Brucellosis in Kuwait: an overlooked endemic zoonosis from a One Health perspective

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Abstract

Brucellosis remains one of the most important endemic zoonoses in Kuwait, affecting both human and animal populations despite decades of control efforts. This review synthesizes published literature and official data on the epidemiology of brucellosis in Kuwait from a One Health perspective, integrating evidence from human health, veterinary surveillance, and livestock control programs. Historical data show a substantial burden of human disease during the 1980s and 1990s, characterized by frequent outbreaks and severe complications, followed by fluctuating incidence in subsequent decades. Animal brucellosis remains endemic, particularly among sheep, goats, cattle, and camels, with *Brucella melitensis* identified as the predominant species in both humans and livestock. Vaccination programs have reduced prevalence but have not achieved sustained elimination. Persistent transmission is driven by close human–animal contact, consumption of unpasteurized dairy products, and gaps in coordinated surveillance and control. The findings highlight the need for integrated One Health strategies, strengthened surveillance, and sustained livestock vaccination to reduce the ongoing public health and economic impact of brucellosis in Kuwait.

Keywords: Brucellosis, Human cases, Kuwait, One Health, Vaccine program

Introduction

Brucellosis is a zoonotic bacterial disease caused by the genus *Brucella* (B). It affects humans and a wide range of animal species, including livestock, companion animals, and wildlife species [1]. To date, more than 12 accepted species of *Brucella* have been described, including *B. abortus* (primary hosts are cattle and buffaloes), *B. melitensis* (primary hosts are sheep and goats), *B. suis* (primary hosts are pigs, wild boar, and reindeer), *B. canis* (primary hosts are dogs), *B. ovis* (primary hosts are rams), *B. neotomae* (primary hosts are desert wood rats), *B. ceti* (primary hosts are cetaceans, i.e., whales and dolphins), *B. pinnipedialis* (primary hosts are seals and sea lions), *B. inopinata* (isolated from the breast of women), *B. microti* (primary hosts are foxes and rodents), *B. papionis* (isolated from clinical specimens obtained from baboons) [2], and *B. vulpis* (isolated from red foxes (*Vulpes vulpes*)) [3]. Recently, a novel *Brucella* species was described from two human clinical cases in French Guiana and formally designated *B. amazoniensis* sp. nov. Moreover, several atypical brucellae that deviate from classical in their phenotypic and genetic characteristics have been described. These isolates have been identified in diverse wildlife hosts, including rodents, amphibians (e.g., White's treefrogs), reptiles, fish, and bats, and remain formally unnamed [4].

Among *Brucella* species, *B. melitensis* is the most virulent in humans, followed by *B. abortus* and *B. suis*. Human infection occurs primarily via direct contact with infected animals or ingestion of contaminated food,

particularly unpasteurized milk and dairy products [5]. Following entry via mucosal surfaces or skin abrasions, the bacteria disseminate through the bloodstream and establish intracellular infection within macrophages and polymorphonuclear cells [5].

Acute brucellosis typically presents as a nonspecific systemic illness characterized by undulating fever, night sweats, malaise, and fatigue. Delayed diagnosis or inadequate treatment may lead to chronic infection with focal complications, including osteoarticular involvement, abscess formation in parenchymal organs, and central nervous system or cardiovascular manifestations [6, 7, 8].

In animals, brucellosis primarily affects the reproductive system, causing late-term abortions, retained placenta, infertility, and reduced milk production; in males, orchitis and epididymitis are common sequelae [9, 10].

Brucellosis remains endemic in many regions worldwide. Although several countries in Western and Northern Europe, Canada, Japan, Australia, and New Zealand have achieved effective control or elimination, the disease persists across much of the Middle East, the Mediterranean basin, sub-Saharan Africa, parts of South America, and China, where it continues to impose significant public health and economic burdens [11]. Kuwait, along with several neighbouring Middle Eastern countries, reports relatively high incidence rates, underscoring the regional burden of infection [11]. This review aims to comprehensively synthesise the historical and current epidemiology of brucellosis in Kuwait by

integrating published evidence, national surveillance data, and veterinary control records to provide a unified One Health perspective on disease dynamics.

Historical background of human brucellosis in Kuwait

Brucellosis has been documented in Kuwait since the late twentieth century and emerged as a major public health concern during the early 1980s. Limited diagnostic capacity and low clinical awareness during the initial phase likely contributed to underreporting and misdiagnosis. An epidemic increase was recorded in 1983, with an annual incidence of 26.8 cases per 100,000 population, rising to 68.9 per 100,000 in 1985 [12].

Between December 1983 and June 1984, 68 cases were admitted to Al-Adan Regional Hospital, corresponding to an estimated annual incidence of 85 per 100,000 population. Of these patients, 84% were Kuwaitis and Bedouins. Consumption of unpasteurized milk was identified as the primary exposure in most cases, while four patients reported direct contact with livestock. Incidence peaked during the animal parturition season and desert camping period, when close human–animal interaction and raw dairy consumption were common [13]. Between 1984 and 1985, 379 additional cases were admitted to the same hospital. The principal exposure pathways remained raw milk consumption and contact with sheep, goats, or camels. Frequently reported complications included osteoarticular involvement, hepatosplenomegaly, and lymphadenopathy [14].

Throughout the 1980s, brucellosis was associated with substantial morbidity. Severe skeletal complications, including disabling bone and joint disease, were reported [15], as well as brainstem abnormalities [16] and sternoclavicular arthritis [17]. Over two years, 22 patients were diagnosed with *Brucella* spondylitis and neurobrucellosis [18], while 24 cases of spinal brucellosis were documented at Al-Razi Hospital [19]. Unusual manifestations included infected epidermal cysts caused by *B. melitensis* [20] and renal impairment [21]. In a cohort of 400 patients, arthritis occurred in 26% (104/400), most commonly affecting the sacroiliac joints (26%), knees (25%), hips (18%), and spine (8%) [22]. Combination antimicrobial therapy, including streptomycin with rifampicin and either cotrimoxazole or tetracycline, was reported to be effective in these series.

Central nervous system (CNS) involvement was documented but remained relatively uncommon in children [23]. Among nine pediatric neurobrucellosis cases, six presented with meningitis and three with encephalitis or meningoencephalitis [24]. In 1985, 1,168 brucellosis cases were reported nationally, with neurological involvement documented in a subset [25]. Sixty-five cases of neuropsychiatric brucellosis were

described, 13.8% of whom demonstrated basal ganglia calcifications on imaging [26].

Pulmonary involvement was rare but reported. Nine patients admitted to Farwania Hospital presented with respiratory symptoms and radiological findings of interstitial pneumonitis or consolidation; *B. melitensis* was isolated from blood in six cases and from pleural fluid in two [27]. A severe case of *Brucella* pneumonitis complicated by acute pulmonary edema and myocarditis was described at Jahra Hospital [28].

A strongly seropositive brucellosis patient with disseminated tuberculosis developed peritonitis, granulomatous hepatitis, and meningitis [29]. Cardiovascular and systemic complications were also documented. Cases included acute pancreatitis caused by *B. melitensis* [30], native aortic valve endocarditis with severe regurgitation and disseminated intravascular coagulation [31], nephritis, hepatitis, and peritonitis in a young shepherd [32] and prosthetic valve endocarditis [33]. In a prospective cohort of 400 patients admitted to Jahra Hospital, 77% presented with acute disease, 12.5% with subacute infection, and 10% with chronic brucellosis; hepatosplenomegaly was observed in 42% [34].

Neonatal brucellosis was reported in several instances. One case suggested probable transmission via breastfeeding [35], while three additional neonatal infections were attributed to maternal infection during pregnancy, although *Brucella* was not isolated from breast milk samples [36]. Between 1985 and 1987, 221 children were admitted with prolonged fever; *Brucella* was identified as the causative agent in 38% of cases, making it the most common infectious etiology, followed by typhoid fever (9%) [37].

Reproductive complications were documented in both women and men. Among 307 women evaluated for obstetric complications, acute or chronic *Brucella* infection was detected in 8% of preterm deliveries, 10% of intrauterine foetal deaths, and 7% of spontaneous abortions, although placental isolation was unsuccessful [38]. In men, epididymo-orchitis was a recognized complication; between 1983 and 1985, 14 of 40 patients presenting with epididymo-orchitis were diagnosed with brucellosis [39].

Diagnosis during this period relied primarily on serological methods, including the standard agglutination test, ELISA for IgG, IgM, and IgA antibodies, and the brucellosis card test [40, 41]. Treatment regimens commonly included combinations of doxycycline or oxytetracycline with rifampicin, trimethoprim–sulfamethoxazole, or intramuscular streptomycin, with favorable clinical outcomes reported in most cases [27].

The *Brucella* situation over the last decades (2000–2025) in humans

Although brucellosis remains endemic in Kuwait, epidemiological research is limited, and no nationwide population-based studies have assessed human prevalence. During the first two decades of the 21st century, most publications consisted of case reports or small clinical series describing specific complications, including osteoarticular lesions identified by magnetic resonance imaging (MRI) [42], hypothermia with pneumonia [43], endocarditis [44], and acute pyelonephritis [45]. In nearly all culture-confirmed cases, *B. melitensis* was the identified species. An additional case described acute brucellosis in a 20-year-old man presenting with fever, purpuric skin lesions, epistaxis, and haematuria, accompanied by mild anaemia and leukopenia [46].

A large seroepidemiological and microbiological investigation conducted between January 2000 and December 2001 included 1,836 patients of various nationalities [47]. Of the sera tested, 455 (24.8%) were positive by the standard tube agglutination (STA) test. *Brucella* spp. were isolated from 123 blood cultures, corresponding to a culture positivity rate of 74.1% among seropositive cases. Antimicrobial susceptibility testing against eight agents demonstrated high *in vitro* activity of tetracycline, gentamicin, amikacin, streptomycin, and ciprofloxacin. In contrast, azithromycin showed activity against 42% of isolates, while rifampicin and trimethoprim–sulfamethoxazole demonstrated lower *in vitro* activity (8% and 25%, respectively). Kuwaiti and Bangladeshi nationals constituted the most affected groups in this cohort [47].

A retrospective review from Farwaniya Hospital (April 2017–February 2019) evaluated 120 patients presenting with epididymitis or orchitis; 31 were diagnosed with brucellosis, and 11 had confirmed *Brucella* orchitis. Notably, 72% of patients reported animal contact. *Brucella* orchitis accounted for approximately 9% of all orchitis cases managed at the hospital during the study period [48]. A systematic review of congenital brucellosis published in 2017 identified five cases originating from Kuwait [49]. During this period, diagnosis relied primarily on serological testing, supplemented by polymerase chain reaction (PCR) and culture confirmation when available [50].

Molecular typing has increasingly contributed to understanding the epidemiology of brucellosis in Kuwait.

In 2017, multilocus variable-number tandem-repeat analysis (MLVA) was performed on 75 human isolates, revealing clustering within MLVA-11 and MLVA-16 genotypes typical of the East Mediterranean region [51]. Comparative phylogenetic analyses demonstrated genetic relatedness between Kuwaiti isolates and strains circulating in Turkey, Iraq, and other Middle Eastern countries [52].

All culture-based investigations in Kuwait have consistently identified *B. melitensis* as the predominant species responsible for human infection. With the advent of next-generation sequencing (NGS), whole-genome sequencing (WGS), and single-nucleotide polymorphism (SNP)-based typing, have provided higher-resolution strain discrimination [53, 54]. The first WGS study in Kuwait characterized five clinical *B. melitensis* isolates using Illumina sequencing technology [55]. A subsequent study analysing 15 clinical isolates from Farwaniya Hospital identified *B. melitensis* biovar 2 as the most prevalent strain, with evidence of genetic heterogeneity among isolates. Phylogenetic comparison with 105 global strains showed that Kuwaiti isolates primarily clustered with Middle Eastern lineages, particularly those from Iraq, Syria, and Turkey [56].

These molecular findings underscore the regional connectivity of brucellosis transmission and highlight the need for expanded genomic surveillance incorporating isolates from multiple healthcare institutions to better characterize circulating biovars and transmission patterns within Kuwait.

Official data on human brucellosis in Kuwait

According to the Ministry of Health (MOH) surveillance data, brucellosis remains an ongoing public health concern in Kuwait. Reported human cases declined steadily between 1985 and 1997, a trend temporally associated with the implementation of livestock vaccination programs. However, a resurgence was observed between 2007 and 2009, Table 1. Following a marked decline in 2011, case numbers increased again, peaking in 2018 at more than 500 reported cases. Thereafter, a gradual reduction was observed. Between 2020 and 2025, annual reported cases stabilised at approximately 200–250 per year, Figure 1.

Table 1: Number of human cases of brucellosis in Kuwait between 1985 and 2009, based on information from the Ministry of Health (MOH).

Year	1985	1988	1993	1994	1995	1996	1997	2007	2008	2009
Number of cases	1,168	394	241	231	210	217	112	3,027	3,048	4,969

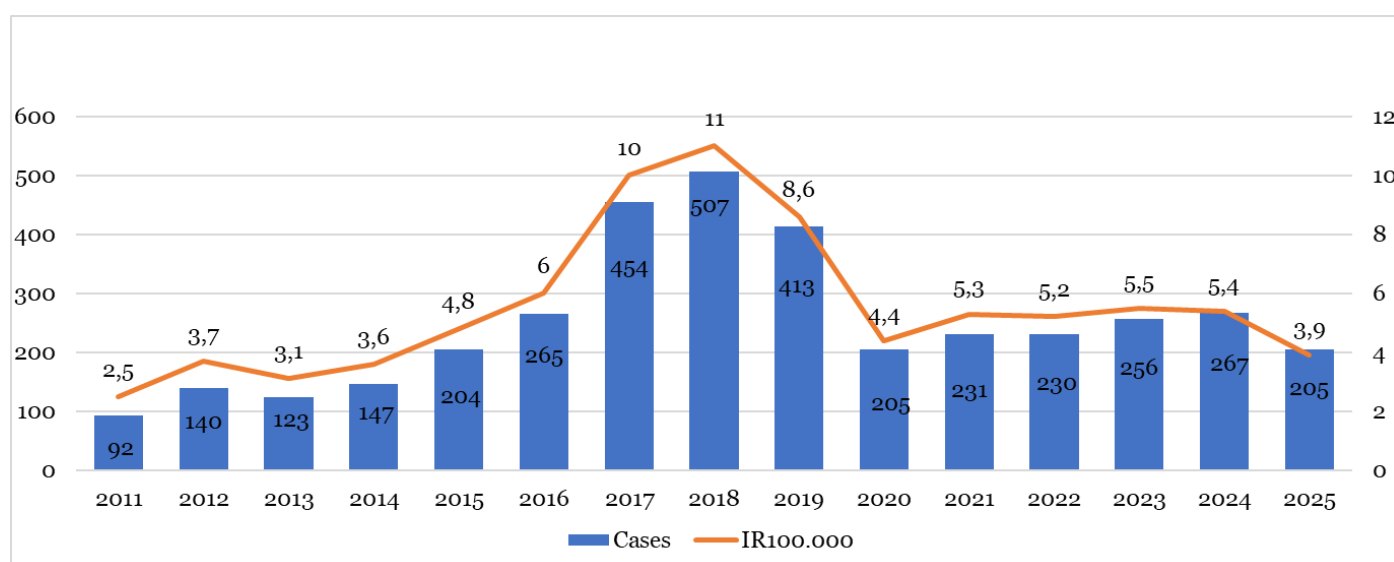


Figure 1: Number of human brucellosis cases and incidence rate (IR) between 2011 and 2025 according to data recorded by the Ministry of Health (MOH).

Animal brucellosis in Kuwait

The State of Kuwait is located in the north-eastern Arabian Peninsula at the northern end of the Arabian Gulf and shares borders with Iraq and Saudi Arabia. Historically, cross-border movement of livestock was facilitated by nomadic pastoral practices; however, border controls are now formally regulated. Kuwait's livestock sector comprises primarily dairy cattle (predominantly Holstein breeds), sheep, goats, and camels. Between 1993 and 2000, livestock populations were extensively restocked, mainly through imports from Syria. Although livestock importation from Syria has since ceased, legal imports continue primarily from Australia, Saudi Arabia, and Iran. In 2015 alone, 1,557,514 sheep, 5,792 goats, 1,904 cattle, and 2,152 camels passed through national quarantine stations. A substantial proportion of small ruminants are managed under extensive or semi-nomadic systems, particularly in Kated (south of Kuwait City), Wafra (along the Saudi border), and Salmiya in the southwest.

Brucellosis remains endemic among small ruminants, cattle, and camels throughout Kuwait. Early investigations (1986–1987) documented infection in a private camel farm, where 104 of 698 sera were positive by Rose Bengal Plate Test (RBPT) and Complement Fixation Test (CFT), and 17 of 209 milk samples were positive by the Milk Ring Test (MRT). *B. abortus* was isolated from two of five tested camel fetuses [57].

Livestock prevalence fluctuated during the 1990s. In cattle, infection prevalence increased from 3.0% in 1984 to 5.2% in 1989. Small ruminants exhibited higher seropositivity, with 11.1% reported in 1986, declining to 6.6% in 1989, followed by an increase to 9.4% in 1993 and a peak of 14% in 1994. In camels, seropositivity was approximately 14% in 1985 and 1988, declining to 7.7% by 1989. Across species, *B. melitensis* was identified as the

predominant pathogen, particularly in sheep and goats, underscoring its central role in zoonotic transmission during this period [12].

A national small ruminant vaccination campaign using a reduced-dose of *B. melitensis* Rev.1 vaccine over a 4.5-year period reduced seroprevalence to 2.02% by 1997 [58, 59]. This marked decline demonstrated the effectiveness of sustained immunization strategies in controlling infection among sheep and goats.

Despite the endemicity of brucellosis in the Middle East, published data on livestock outbreaks in the Gulf region remain limited [60]. Over the past two decades, few comprehensive epidemiological studies have been reported, highlighting substantial gaps in systematic surveillance and regional data sharing.

A nationwide seroprevalence study in lactating dairy cows included 4,671 serum samples collected from apparently healthy animals across major dairy-producing regions. Testing by Buffered Acidified Plate Antigen Test (BAPAT), RBPT, and CFT identified 7% seropositivity. *B. melitensis* biovar 2 was isolated from two bovine fetuses [61]. These findings confirm continued circulation of *Brucella* within dairy herds and underscore the potential public health implications associated with raw milk exposure.

The first large-scale national survey of sheep brucellosis (2016–2019) analysed 67,054 serum samples from 233 herds across five high-density livestock districts. Seroprevalence was 7% in districts without prior vaccination compared to 4.7% in vaccinated districts. Combined vaccination with *B. melitensis* Rev.1 and targeted test-and-slaughter interventions in 20 herds further reduced seroprevalence. *B. melitensis* was isolated from 20 samples, representing 43.5% of bacteriologically tested specimens. Notably, 56.6% of examined animal

owners were seropositive by RBT, BAPAT, and CFT, indicating substantial occupational exposure and ongoing zoonotic risk [62].

Overall, the epidemiological profile of livestock brucellosis in Kuwait parallels that of neighbouring countries, emphasising the need for sustained national control programs and coordinated regional strategies to reduce transmission across borders.

Control of animal brucellosis in Kuwait using a vaccination program

The data presented in this section are derived from official records of the Public Authority for Agriculture Affairs and Fish Resources (PAAF), the governmental body responsible for agricultural policy and livestock health management in Kuwait. Brucellosis was first diagnosed in Kuwait in 1963. Since then, multiple control initiatives have been introduced over subsequent decades; however, early efforts were discontinued due to limited effectiveness. Prior to 1984, the primary control strategy consisted of test-and-slaughter of seropositive animals, with financial compensation to owners. This approach was ultimately abandoned because it did not achieve sustained reductions in disease incidence.

Between 1984 and 1986, seroprevalence in dairy cattle increased from 3.0% to 9.6%. Sporadic abortions attributed to *B. melitensis* were reported in affected herds. In December 1986, a large-scale control program targeting small ruminants was initiated. Initial vaccination efforts reduced ovine and caprine seroprevalence to 6.5%. Some farmers reported post-vaccination abortions, for which government compensation was provided. A serological survey conducted between May and August 1993 identified a seroprevalence of 12.9% in sheep samples submitted for laboratory testing in 1994. *B. melitensis* was isolated from five sheep, two goats, and two cattle during this period.

A structured mass vaccination program using a reduced-dose (1/50) *B. melitensis* Rev.1 vaccine administered subcutaneously was implemented between 1993 and 1997 and remains in use as of 2026. According to a 1997 survey, small ruminant seroprevalence declined from approximately 6% to 2.02% following sustained vaccination [58, 59]. This decline coincided with a reduction in reported human cases from 1,168 in 1985 to

112 in 1997; however, direct causality cannot be conclusively established due to the absence of integrated human–animal surveillance data.

In 2015, PAAF contracted a private veterinary provider to implement a national surveillance and control program for brucellosis in cattle and small ruminants. In cattle, the strategy emphasized test-and-slaughter with full owner compensation and destruction of aborted or seropositive animals. While effective in reducing apparent prevalence, this approach proved financially burdensome, prompting consideration of heifer vaccination as a more sustainable strategy. In small ruminants, vaccination of female lambs aged 3–5 months remains the primary preventive measure.

As shown in Table 2, both annual prevalence and infection rates declined following implementation of the RB51 vaccination program in cattle. However, interpretation of these reductions should consider concurrent removal of seropositive animals and variations in sampling intensity across years. Although prevalence decreased, complete eradication has not been achieved.

Periodic vaccination of infected cattle farms with RB51 was associated with reduced infection rates, lower compensation costs, improved reproductive performance, decreased abortion frequency, and reduced reliance on imported replacement animals. Farms declared free of infection after three consecutive negative monthly serological tests were subsequently monitored at extended intervals, reducing diagnostic and operational costs. Nonetheless, sustained control will depend on consistent vaccination coverage, reliable traceability systems, and strengthened integration between veterinary and public health surveillance.

The control strategy also incorporated livestock identification systems to facilitate vaccination tracking and subsidy management. Initial identification methods included plastic ear tags and ear punching, but these were inconsistently adopted due to ease of tag removal and breeder resistance to ear notching. In 2009, RFID-based identification was introduced to record animal identity, vaccination status, and subsidy allocation. However, implementation has been incomplete; currently, only cattle are routinely identified, primarily using plastic ear tags, while no standardized national identification system exists for sheep, goats, or camels.

Table 2: Number of samples tested, annual prevalence, and infection rates of brucellosis before and after immunization with the RB51 vaccine during the period from April 2015 to November 2023 in Sulaibiya area, the main dairy farm region in Kuwait.

	Before using RB51				After using RB51				
	2015	2016	2017	2018	2019	2020	2021	2022	2023
Samples tested	2,092	104,905	98,047	8,730	60,079	24,286	7,339	34,392	39,131
Annual prevalence	5.85	3.47	6.55	4.04	1.35	0.18	0.64	0.43	0.28
Infection rate	%1.79	%0.63	%1.27	%1.31	%0.43	%0.128	0.29	%0.25	%0.14

Conclusion

Although brucellosis is endemic in Kuwait, comprehensive epidemiological data remain limited. Population-based estimates of human prevalence are scarce, and systematic surveillance data in livestock are similarly incomplete. Nonetheless, available evidence indicates sustained transmission in cattle, sheep, goats, and camels, with continued zoonotic risk among individuals with occupational or dietary exposure. A regional epidemiological assessment reported approximately 446 human cases in Kuwait in recent years, corresponding to an incidence of 10.8 per 100,000 population [63].

The principal risk factors for human infection include consumption of unpasteurized dairy products and direct contact with infected animals. Additional transmission pathways include handling contaminated animal products, exposure to infectious aerosols, and accidental laboratory or occupational inoculation. Although mass vaccination programs and test-and-slaughter strategies have reduced infection levels in livestock, complete interruption of transmission has not been achieved. Furthermore, molecular characterization and systematic investigation of circulating *Brucella* strains remain limited.

Brucellosis continues to represent a significant public health and veterinary challenge in Kuwait. Sustained reduction of human incidence will depend on effective control of infection in animal reservoirs, strengthened surveillance integration, improved food safety practices, particularly avoidance of raw dairy products and targeted occupational protection for high-risk groups. Public health interventions, including community education and strict enforcement of milk pasteurisation, remain essential components of disease control.

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