

An Overview of Camel Brucellosis and Its Impact on Human Health in Endemic Regions

Ahmed Abdel-Rady^{1,2}, **Hanin Ashraf Abu-Seida**³ and **Ashraf M. Abu-Seida**^{4,5}

¹Department of Animal Medicine (Infectious Diseases), Faculty of Veterinary Medicine, Assiut University, Assiut, Egypt.

²Consultant of Infectious Diseases, Animal Health Laboratory in Dammam, WEQAA-Center, Dammam, Kingdom of Saudi Arabia.

³Faculty of Physical Therapy and Rehabilitation, Galala University, New Galala City, Suez, Egypt.

⁴Department of Surgery, Anesthesiology and Radiology, Faculty of Veterinary Medicine, Cairo University, Giza, Egypt. https://orcid.org/0000-0001-5466-2016_ashrafseida@cu.edu.eg

⁵Animal Research Facility, Galala University, New Galala City, Suez, Egypt.

Publication: Published Online: 18 September 2025

Abstract

Background: Camel brucellosis is a zoonotic disease caused by the genus *Brucella* and has significant economic and public health effects worldwide, particularly in areas where camels play a significant role in the pastoral economy. This review describes the epidemiological aspects of camel brucellosis and its impact on human health.

Methods: A comprehensive literature search was performed using PubMed, Web of Science, Scopus, and Google Scholar databases to locate studies on camel brucellosis for recognizing its epidemiological aspects and impact on human health. The search included 274 documents.

Results: The disease results in reduced milk output, reproductive failures, arthritis, and financial losses for farmers. The seroprevalence of camel brucellosis across the camel-rearing countries is alarming and ranges between 0.4 and 37.5%. Sudan and the Kingdom of Saudi Arabia are the most affected countries with camel brucellosis. Three species were isolated from diseased camels, including *B. abortus*, *B. melitensis*, and *B. suis*. The potential risk factors of camel brucellosis include age, body condition, gender, physiological status and breed of the camel, herd size, contact with cattle and small ruminants, management, history of abortion, locality, and season. Accurate diagnosis of camel brucellosis is essential for effective management of the disease. Serodiagnosis is still one of the most used techniques for identifying the affected animals.

Conclusions: A one-health strategy is required from the governments, animal health professionals, and other stakeholders to combat the disease. This strategy includes enhancing veterinary care, increasing public and herders awareness toward the zoonotic importance of the disease as well as value of biosecurity procedures, and putting in place efficient immunization programs aimed at high-risk groups. Due to the socioeconomic impact of camel brucellosis, it is crucial to understand its epidemiology and potential risk factors to implement effective control strategies.

Keywords:

Brucella spp.; complement fixation test; dromedary; enzyme-linked immunosorbent assay; Rose Bengal plate test; seroprevalence

References:

- Abbas B, Agab H. A review of camel brucellosis. *Prev Vet Med* 2002; 55(1):47–56;
- Moghney ARF. A preliminary study on brucellosis on camels at Behira province. *Assiut Univ Bull Environ Res* 2004; 7(1):39–43.
- Abou Gazia KA, Sherif HR, Elsify A, et al. Seroprevalence of camel brucellosis in Egypt. *Vet Med J (Giza)* 2019; 65(1):18–21.
- Abu Sulayman SM, Bora RS, Sabir JSM, et al. Brucellosis: status of the disease and future perspectives. *Adv Microbiol* 2020; 59 (4):337–344;
- Abu-Seida AM, Hassan MH, Abdulkarim A, et al. Recent progress in camel research. *Open Vet J* 2024;14 (11):2877–2882;
- Adama NB, Okoh AEJ, Azunku UJ. Prevalence of brucellosis in nomadic herds of dromedaries in Borno State. *Nigeria. J Camel Pract Res* 2007;14 (2):135–138.
- Agab H, Abbas B, Ahmed HJ, et al. First report on the isolation of *Brucella abortus* biovar 3 from camels (*Camelus dromedarius*) in Sudan. *Rev Elev Med Vet Pays Trop* 1994; 47(4):361–363.
- Ahad AA, Megersa B, Edao BM. Brucellosis in camel, small ruminants, and Somali pastoralists in Eastern Ethiopia: A One Health approach. *Front Vet Sci* 2024; 11:1276275
- Akoko JM, Mwatondo A, Muturi M, et al. Mapping brucellosis risk in Kenya and its implications for control strategies in sub-Saharan Africa. *Sci Rep* 2023; 13 (1):20192;
- Al-Ani FK, Al-Sharrify M, Khalil F. Serological survey on camel brucellosis in camels in Iraq. *Camel Newsl* 1998; 14: 32–33.
- Alhussain H, Zughaier SM, Gawish A, et al. Seroprevalence of camel brucellosis in Qatar. *Trop Anim Health Prod* 2022; 54 (6):351;
- Ali S, Saeed U, Rizwan M, et al. Serosurvey and risk factors associated with *Brucella* infection in high risk occupations from District Lahore and Kasur of Punjab, Pakistan. *Pathogens* 2021; 10 (5):620;
- Aliyi S, Aragaw, K, Geinoro T. *Brucella* exposure in camels and health impact in Lega Hida, Ethiopia: Seroprevalence, risk factors, and public perception. *J Zoon Dis* 2024; 8(3):534–546;

Al-Khalaf S, El-Khaladi A. Brucellosis of camels in Kuwait. *Comp Immunol Microbiol Infect Dis* 1989; 12 (1–2):1–4;

Al-Majali AM, Al-Qudah KM, Al-Tarazi YH, et al. Risk factors associated with camel brucellosis in Jordan. *Trop Anim Health Prod* 2008; 40 (3):193–200;

Almuzaini AM, Aljohani ASM, Alajaji AI, et al. Seroprevalence of brucellosis in camels and humans in the Al-Qassim region of Saudi Arabia and its implications for public health. *AMB Expr* 2025;15 (1):22;

Alshaikh MAA, Al Haidary A, Aljumaah RS, et al. Camel brucellosis in Riyadh region, Saudi Arabia. *J Camel Pract Res* 2007;14 (2):113–117.

Alton GG, Forsyth JRL. Brucella. In: Baron S., editor. *Medical Microbiology*. 4th edition. University of Texas Medical Branch at Galveston: Galveston (TX); 1996. <https://www.ncbi.nlm.nih.gov/books/NBK8572/>

Alton GG, Jones LM, Pietz DE. Laboratory techniques in brucellosis. 2nd ed. World Health Organization, 1988. Available from: <https://iris.who.int/handle/10665/38676> [Last accessed: January 23, 2025].

Ameni G, Zewude A, Bayissa B, et al. Seroprevalence and molecular detection of Brucella infection in livestock in the United Arab Emirates. *Int J Vet Sci Med* 2024; 12 (1):91–100;

Andrade RS, de Oliveira MM, Filho JS, et al. Accuracy of serological tests for bovine brucellosis: A systematic review and meta-analysis. *Prev Vet Med* 2024; 222:106079;

Arellano-Reynoso B, Diaz-Aparicio E, Leal-Hernandez M, et al. Intracellular trafficking study of RB51 *B. abortus* vaccinal strain isolated from cow's milk. *Vet Microbiol* 2004; 98 (3–4):307–312;

Asakura S, Makingi G, John K, et al. Use of a participatory ethod for community-based brucellosis control design in agro-pastoral areas in Tanzania. *Front Vet Sci* 2022; 9: 767198;

Ashour G, El Bahrawy K, Abdel-Rahman SM. Climate changes and camels: Exploring adaptations to harsh conditions. *Egypt J Camel Sci* 2024;2 (2):63–72;

Asmelash A, Achalu D, Tuli D. Seroprevalence and associated risk factors of camel brucellosis in the gumbi bordode district of the Oromia Region, Eastern Ethiopia. *Vet Med Int* 2025; 1: 5581975;

Baloch AS, Rasheed A, Rind R, et al. Seroprevalence of brucellosis in camels in Sindh, Pakistan. *PJZ* 2016; 49(1):367–369;

Bashir HM, Abraheem HH, Khogly MI, et al. Epidemiology of camel brucellosis intended for export from Kassala State –Eastern Sudan. *Int J Appl Sci Biotechnol* 2022;10 (4):216–220;

Baumann MPO, Zessin KH. Productivity and health of camels (*Camelus dromedarius*) in Somalia: Associations with trypanosomiasis and brucellosis. *Trop Anim Health Prod* 1992; 24 (3):145–156;

Bayasgalan C, Chultemdorj T, Roth F, et al. Risk factors of brucellosis seropositivity in Bactrian camels of Mongolia. *BMC Vet Res* 2018; 14 (1):342;

Bekele WA, Tessema TS, Melaku SK. *Camelus dromedarius* brucellosis and its public health associated risks in the afar national regional state in Northeastern Ethiopia. *Acta Vet Scand* 2013; 55(1):89;

Benfodi K, Cherif AM, Ansel S, et al. Seroprevalence and associated risk factors for camel brucellosis in South Algeria. *Veterinaria (1964)* 2022; 71 (1):17–26;

Corbel MJ. ‘Brucellosis in humans and animals.’ World Organization for Animal Health, 2006. Available from: <https://www.who.int/publications/i/item/9789241547130> [Last accessed: January 27, 2025].

Dadar M, Alamian S. Isolation of *Brucella melitensis* from seronegative camel: Potential implications in brucellosis control. *Prev Vet Med* 2020; 185:105194;

Dadar M, Tiwari R, Sharun K, et al. Importance of brucellosis control programs of livestock on the improvement of one health. *Vet Q* 2021; 41(1):137–151;

Daugaliyeva A, Daugaliyeva S, Abutalip A, et al. Study of epidemiological and molecular characteristics of *Brucella* strains circulating in Kazakhstan. *Vet Res Commun* 2025; 49(3):156;

Dawood HA. Brucellosis in camels (*Camelus dromedarius*) in Jordan. *Am J Agr Biol Sci* 2008; 3: 623–626.

Djangwani J, Abong GO, Njue LG, et al. Brucellosis: Prevalence with reference to East African community countries – A rapid review. *Vet Med Sci* 2021;7 (3):851–867;

Dorneles EM, Sriranganathan N, Lage AP. Recent advances in *Brucella abortus* vaccines. *Vet Res* 2015;46 (1):76;

Ebrahimi A, Hosseinpour F, Montazeri B. Seroprevalence of brucellosis in dromedaries in Iran. *J Camel Pract Res* 2007; 14 (1):43–44.

Edema WW, Hunderra GC, Neja SA. Camel brucellosis: Seroprevalence, associated risk factor, and public health perceptions in Arero District of Borena Zone, Southern Ethiopia. *Vet Med Int* 2025; 2025: 3722054;

El-Seedy FR, Radwan AI, El-Shabrawy MA. Serological and bacteriological investigations on *Brucella* infection in one-humped camels, *Camelus dromedarius* in Egypt. *Vet Med J (Giza)* 2000; 48:83–89;

Eltholth MM, Hegazy YM, El-Tras WF, et al. Temporal analysis and costs of ruminant Brucellosis control programme in Egypt between 1999 and 2011. *Transbound Emerg Dis* 2017;64(4):1191–1199;

Ergönül O, Celikbaş A, Tezeren D, et al. Analysis of risk factors for laboratory acquired *brucella* infections. *J Hosp Infect* 2004; 56 (3):223–227;

Farah Z, Mollet M, Younan M, et al. Camel dairy in Somalia: Limiting factors and developmental potential. *Livestock Sci* 2007; 110 (1–2):187–191;

Gameel SE, Mohamed SO, Mustafa AA, et al. Prevalence of camel brucellosis in Libya. *Trop Anim Health Prod* 1993; 25 (2):91–93;

Garcell HG, Garcia EG, Pueyo PV, et al. Outbreaks of brucellosis related to the consumption of unpasteurized camel milk. *J Infect Public Health* 2016; 9 (4):523–527;

Getachew A, De Massis F, Mekonnen B, et al. Seroprevalence, characterization, and risk factors of brucellosis in cattle, sheep, goats, and camels in the Oromia region, Borena Zone, Ethiopia. *Prev Vet Med* 2025; 244:106634;

Ghanem YM, El-Khodery SA, Saad AA, et al. Seroprevalence of camel brucellosis (*Camelus dromedarius*) in Somaliland. *Trop Anim Health Prod* 2009; 41(8):1779–1786;

Gibbs SJ. Infectious Diseases: Brucellosis. In *Encyclopedia of Dairy Sciences* (Third edition), Academic Press, 2022; pp: 317–322.

Godfroid J, Al Dahouk S, Pappas G, et al. “one health” surveillance and control of brucellosis in developing countries: Moving away from improvisation. *Comp Immunol Microbiol Infect Dis* 2013;36 (3):241–248.

Godfroid J, Nielsen K, Saegerman C. Diagnosis of brucellosis in livestock and wildlife. *Croat Med J* 2010; 51 (4):296–305;

Greenfield RA, Drevets DA, Machado LJ, et al. Bacterial pathogens as biological weapons and agents of bioterrorism. *Am J Med Sci* 2002; 323(6):299–315;

Gwida M, El-Gohary A, Melzer F, et al. Brucellosis in camels. *Res Vet Sci* 2012; 92(3):351–355.

Gwida MMAS. Isolation, identification and typing of *Brucella* species as zoonotic pathogens by using conventional and molecular biological methods. DVM Thesis, Free University of Berlin, Germany, 2010.

Hanon BM. Seroprevalence of brucellosis and toxoplasmosis in camels of Wasit Province. *Iraq. Al-Qadisiyah J Vet Med Sci* 2017; 16 (2):29–37.

Harby HAM, Ismaily SLN. The prevalence of brucellosis among livestock in the Sultanate of Oman. *Pro. Int Conf Livestock Prod Hot Clim* 1995.

Hegazy YM, Molina-Flores B, Shafik H, et al. Ruminant brucellosis in Upper Egypt 2005–2008. *Prev Vet Med* 2011; 101 (3–4):173–181;

Holloway P, Gibson M, Holloway T, et al. Camel milk is a neglected source of brucellosis among rural Arab communities. *Nat Commun* 2025; 16 (1):861;

Hosein HI, Roubay S, Menshawy A, et al. Seroprevalence of camel brucellosis and molecular characterization of *Brucella melitensis* recovered from dromedary camels in Egypt. *Res J Vet Pract* 2016; 4 (1):17–24;

Hoseyni SA, Akbari H, Jafari-Khataylou Y, Hajibemani A. Serological investigation of brucellosis in one-humped camels (*Camelus dromedarius*) of Yazd province in Iran. *J Zoon Dis* 2025;9 (1):730–737;

Hussein M, El-Diasty M, Farag VM, et al. Seroprevalence and molecular investigation of camel brucellosis in Egypt with emphasis on potential risk factors. *Gr J Vet Res* 2025; 5 (2):15–23;

Jara R, Alemayehu M, Wubishet Z, et al. Sero-prevalence and associated risk factors of camel brucellosis in Southern lowland of Ethiopia. *J Vet Med Res* 2020; 7 (1):1180.

Jones RD, Kelly L, England T, et al. A quantitative risk assessment for the importation of brucellosis-infected breeding cattle into Great Britain from selected European countries. *Prev Vet Med* 2004; 63(1–2):51–61;

Khadjeh G, Zowghi E, Zarif-Fard MR. Incidence of brucellosis in one-humped camels of Boushehr, Iran. *Arch Razi Inst* 1999; 50:83–86.

Khalafalla AI. Zoonotic diseases transmitted from the camels. *Front Vet Sci* 2023; 10:1244833;

Khan AU, Sayour AE, Melzer F, et al. Seroprevalence and molecular identification of *Brucella* spp. in camels in Egypt. *Microorganisms* 2020; 8(7):1035;

Khan MZ, Zahoor M. An overview of brucellosis in cattle and humans, and its serological and molecular diagnosis in control strategies. *Trop Med Infect Dis* 2018; 3 (2):65;

Kulakov IK, Erdenbaator J, Zheludkov MM, Korenberg EI. Genetic characterization of the *Brucella melitensis* isolates from Mongolia, Russia, and Azerbaijan. *Mol Gen Mikrobiol Virusol* 2011(2):8–12.

Lokamar PN, Kutwah MA, Atieli H, et al. Socio-economic impacts of brucellosis on livestock production and reproduction performance in Koibatek and Marigat regions, Baringo County, Kenya. *BMC Vet Res* 2020; 16 (1):61;

Mantur BG, Amarnath SK, Shinde RS. Review of clinical and laboratory features of human brucellosis. *Indian J Med Microbiol* 2007; 25 (3):188–202;

Mantur BG, Amarnath SK. Brucellosis in India- A review. *J Biosci* 2008; 33(4):539–547;

Menshawy AMS, Vicente AF, Hegazy YM, et al. Animal brucellosis in Egypt: Review on evolution, epidemiological situation, prevalent brucella strains, genetic diversity, and assessment of implemented national control measures. *Microorganisms* 2025; 13 (1):170;

Mocalov VI. About the prevalence of brucellosis in cattle and camels [in Russian]. *Bull Sci Res Inst Exp Vet Med Moscow* 1991:41–45.

Mohammed A, Ahmed M, Ahmed AO, et al. Seroprevalence and risk factors of brucellosis in dromedary camels (*Camelus dromedarius*) in Sudan from 1980 to 2020: A systematic review and meta-analysis. *Vet Quart* 2023; 43(1):1–15;

Mohammed Babiker MH, Alamin A, et al. Prevalence and control of brucellosis in Saudi camel Herds. *J Vet Med Animal Sci* 2022; 5(1):1098.

Mohamud AS, Kothowa JP, Mfunne RL, et al. Seroprevalence and risk factors associated with *Brucella* infection in camels in the Puntland State of Somalia. *Vet Sci* 2021; 8 (7):137;

Moti TB. Seroprevalence of camel brucellosis in export farm, Ethiopia. *Anim Vet Sci* 2022; 10 (3):68–72;

Musa MT, Eisa MZ, El Sanousi EM, et al. Brucellosis in camels (*Camelus dromedarius*) in Darfur, Western Sudan. *J Comp Pathol* 2008; 138 (2–3):151–155;

Musa MT, Shigidi MTA. Brucellosis in camels in intensive animal breeding areas of Sudan. Implications in abortion and early-life infections. *Revue Élev Méd Vét Pays Trop* 2001;54(1):11–15.

Nabout FM, Diab MS, Saad WA, et al. Seroprevalence study of animal brucellosis in New Valley Governorate, Egypt. *N Valley Vet J* 2023; 3(2):0.

Nada AR, Ismail EM, Shawkat ME, et al. Studies on brucellosis in camels in Egypt. *Egypt J Vet Sci* 1991; 28:91–101.

Naseer A, Mo S, Olsen SC, et al. *Brucella melitensis* vaccines: A systematic review. *Agriculture* 2023; 13 (11):2137;

Nielsen K, Yu WL. Serological diagnosis of brucellosis. *Prilozi* 2010; 31 (1):65–89.

OIE. *Brucellosis (Brucella Abortus, B. Melitensis and B. Suis) (Infection with B. Abortus, B. Melitensis and B. Suis) Manual of Diagnostic Tests and Vaccines for Terrestrial Animals*. OIE: Paris; 2019. 355–98.

Omer MM, Musa MT, Bakhiet MR, et al. Brucellosis in camels, cattle, and humans: Associations and evaluation of serological tests used for diagnosis of the disease in certain nomadic localities in Sudan. *Rev Sci Tech* 2010; 29(3):663–669;

Pappas G, Akritidis N, Bosilkovski M, et al. Brucellosis. *N Engl J Med* 2005; 352 (22):2325–2336;

Peeridogaheh H, Golmohammadi MG, Pourfarzi F. Evaluation of ELISA and Brucellacapt tests for diagnosis of human Brucellosis. *Iran J Microbiol* 2013; 5 (1):14–18.

Perrett LL, McGiven JA, Brew SD, et al. Evaluation of competitive ELISA for detection of antibodies to *Brucella* infection in domestic animals. *Croat Med J* 2010; 51(4):314–319;

Pizarro-Cerda J, Moreno E, Gorvel JP. Invasion and intracellular trafficking of *Brucella abortus* in nonphagocytic cells. *Microbes Infect* 2000; 2(7):829–835;

Qureshi KA, Parvez A, Fahmy NA, et al. Brucellosis: Epidemiology, pathogenesis, diagnosis and treatment—a comprehensive review. *Ann Med* 2023; 55 (2):2295398;

Radwan AI, Bekairi SI, Mukayel AA, et al. Control of *Brucella melitensis* infection in a large camel herd in Saudi Arabia using antibiotherapy and vaccination with Rev 1 vaccine. *Rev Sci Tech* 1995; 14(3):719–732;

Radwan AI, Bekairi SI, Prasad PV. Serological and bacteriological study of brucellosis in camels in central Saudi Arabia. *Rev Sci Tech* 1992; 11(3):837–844;

Rahman H, Kamboh AA, Korejo NA, et al. Seroprevalence of brucellosis in camels in district Sibi. *Balochistan. J Anim Health Prod* 2022; 10 (2):153–157;

Ramadan RO, Hatem ME, Bey MRA. Isolation of *Brucella melitensis* from carpal hygroma in camels. *J Camel Pract Res* 1998; 5:239–241.

Rawahi AHA, Robertson I, Hussain MH, et al. A cross-sectional seroepidemiological study of camel (*Camelus dromedarius*) brucellosis and associated risk factors in the Sultanate of Oman. *Open Vet J* 2019; 9(2):133–139;

Rojas X, Muñoz S, Otto B, et al. The use of Polarized Fluorescence assay (PF) and competitive ELISA test (c-ELISA) for the diagnosis of brucellosis in South American camelids. *Arch Med Vet* 2004; 36 (1):59–64.

Roushan MRH, Mohraz M, Hajiahmadi M, et al. Efficacy of gentamicin plus doxycycline versus Streptomycin plus Doxycycline in the treatment of Brucellosis in humans. *Clin Infect Dis* 2006; 42(8):1075–1080;

Roushan MRH, Ebrahimpour S. Human brucellosis: An overview. *Caspian J Intern Med* 2015;6 (1):46–47.

Saeed U, Ali S, Khan TM, et al. Seroepidemiology and the molecular detection of animal brucellosis in Punjab, Pakistan. *Microorganisms* 2019;7 (10):449;

Samaha H, Mohamed TR, Khoudair RM. Sero-diagnosis of brucellosis in cattle and humans in Egypt. *Immunobiology* 2009; 214(3):223–226;

Schelling E, Diguimbaye C, Daoud S, et al. Brucellosis and Q-fever seroprevalences of nomadic pastoralists and their livestock in Chad. *Prev Vet Med* 2003; 61 (4):279–293;

Schulze Zur Wiesch J, Wichmann D, Sobottka I, et al. Genomic tandem repeat analysis proves laboratory-acquired brucellosis in veterinary (camel) laboratory in the United Arab Emirates. *Zoonoses Public Health* 2010; 57(5):315–317;

Shahbazzpour N, Hosseini E, Behbahan SEB, et al. The prevalence of *Brucella* spp. in dairy products in Iran: A systematic review and meta-analysis. *Foodborne Pathog Dis* 2025; 22(2):71–85;

Shahzad A, Khan A, Khan MZ, et al. Seroprevalence and molecular investigation of brucellosis in camels of selected districts of Punjab, Pakistan. *Thai J Vet Med* 2017; 47(2):207–215.

Shome R, Gupta VK, Bhardwaj B, et al. A report of seroprevalence of camel brucellosis in India. *J Camel Pract Res* 2013; 20 (2):183–186.

Shumilov KV. Diagnostic value of agglutination and complement fixation test for brucellosis in camels. *Proc All Union Inst Exp Vet Med* 1974; 42:279–282.

Sprague LD, Al-Dahouk S, Neubauer H. A review on camel brucellosis: A zoonosis sustained by ignorance and indifference. *Pathog Glob Health* 2012; 106 (3):144–149;

Ten VB, Cejdačmedova RD. Diagnosis of brucellosis in camels [in Russian]. *Dositizenie Nauki i Techniki* 1993;1:31.

Teshager D, Ahmed S, Ashenafi S, Fanuel Bizuayehu Y. Seroprevalence of brucellosis in camels and goats and community awareness towards its zoonotic risk in selected districts of Afar region, Ethiopia. *Vet Med Int* 2025;1: 5931752;

Teshome H, Molla B, Tibbo M. A seroprevalence study of camel brucellosis in three camel-rearing regions of Ethiopia. *Trop Anim Health Prod* 2003; 35(5):381–390;

Tuon FF, Gondolfo RB, Cerchiari N. Human to human transmission of *Brucella*- A systematic review. *Trop Med Int Health* 2017; 22(5):539–546;

Uzal FA, Carrasco AE, Nielsen KH. Evaluation of a competitive ELISA for the diagnosis of brucellosis in cattle. *Vet Res Commun* 1996; 20(5):421–426;

Waghela S, Fazil MA, Gathuma JM, et al. A serological survey of brucellosis in camels in northeastern province of Kenya. *Trop Anim Health Prod* 1978;10(1):28–29.

Waji W, Neja SA. Camel brucellosis in Ethiopia: Seroprevalence and associated risk factor. *J Vet Healthcare* 2023; 3 (1):14–30;

Waktole H, Aden M, Ashenafi H. Seroepidemiology of camel brucellosis in and around Dire Dawa, Eastern Ethiopia. *Vet Med Int* 2022; 2022:6624293;

Wario GD, Wubaye AM, Mohammed C, Beriso TE. Sero-prevalence, associated risk factors and economic impact of camel brucellosis in Elwayye district, southern Ethiopia. *Comp Immunol Microbiol Infect Dis* 2024; 114:102257;

Wegi FG, Amenu K, Chalchisa A, Mamo G. Brucellosis in camels and humans: Seroprevalence and associated risk factors in Amibara District of Afar Region, Ethiopia. *Vet Med Int* 2021; 2021:5482725;

Wernery U, Kinne J, Joseph M, et al. Where do Brucella organisms hide in serologically positive lactating dromedaries. *Proc IntCamel Conf* 2007:68–70. College of Veterinary and Animal Sciences, Rajasthan Agricultural University, Bikaner, India,

Wernery U. Camelid brucellosis: A review. *Rev Sci Tech Off Int Epiz* 2014; 33(3):1–46.

World Health Organization. *Fact sheet N173*. World Health Organization: Geneva, Switzerland; 1997.

Yawoz M, Jaafar SE, Salih AI, et al. A serological study of brucellosis in camels South of Kirkuk, Iraq. *Ijvs* 2012; 26(2):105–107;

Zhang N, Zhou H, Huang D, et al. Brucellosis awareness and knowledge in communities worldwide: A systematic review and meta-analysis of 79 observational studies. *PLoS Negl Trop Dis* 2019; 13(5):e0007366;

Zhu S, Zimmerman D, Deem SL. A review of zoonotic pathogens of dromedary camels. *Ecohealth* 2019;16 (2):356–377;

Zowghi E, Ebadi A. Brucellosis in camels in Iran. *Rev Sci Tech* 1988; 7(2):383–386;