Review Article

Canine brucellosis- a comprehensive review

ABSTRACT

Canine brucellosis, caused by *Brucella canis*, is a global infectious and zoonotic disease that poses a significant public health risk due to the close interactions between dogs and humans. In dogs, the disease can lead to abortion outbreaks, reproductive failures, lymphadenopathy, and occasionally osteoarticular issues. Asymptomatic infections are also relatively common. In humans, brucellosis typically presents with a febrile illness and non-specific symptoms such as splenomegaly, fatigue, and weakness. The disease is notably problematic in breeding programs due to reproductive failures, including infertility and abortion, leading to substantial economic losses. Transmission occurs through direct contact with infected bodily fluids, particularly during mating, or via contaminated environments. Diagnosing canine brucellosis accurately is critical and can be achieved using various methods, including bacterial cultures, serological tests like the Rose Bengal Plate Test (RBPT) and Enzyme-Linked Immunosorbent Assay (ELISA), and molecular techniques such as polymerase chain reaction (PCR). Treatment is limited, with neutering and antibiotic therapy being the main approaches, though these do not always ensure complete recovery. Preventive measures are essential and include regular screening of breeding dogs, isolation of infected animals, and strict biosecurity protocols. Given its zoonotic potential, it is crucial for veterinary professionals and pet owners to be aware of the disease. Increased awareness and future research on new diagnostic methods and effective vaccines are vital for improving control strategies and reducing the impact of canine brucellosis on both canine and human health.

Key words: Canine brucellosis, public health significance, zoonotic disease

1. INTRODUCTION

The domestic dog (*Canis lupus familiaris*) was the first wild animal to be domesticated, over 10,000 years ago. Today, dogs serve a variety of roles, including as pets, companions in activities such as hunting and herding, assisting in tasks like pulling loads, and aiding the police, military, and individuals with disabilities (Van-Duijkeren, 1992). This significant relationship with humans has earned dogs the title of "man's best friend." Many dog owners regard their pets as family members, with children and the elderly often forming strong bonds with them (Buhmann *et al.,* 2019).

In recent decades, canine breeding has expanded considerably due to a growing demand for purebred, high-pedigree dogs, turning it into a lucrative business. Increased awareness of reproductive challenges, coupled with advancements in reproduction science, has led breeders to seek veterinary support for improving fertility and fecundity (Abraham *et al.,* 2018).Normal fertility in female dogs involves sperm fertilization within the fallopian tubes and subsequent implantation in the uterus until whelping. While much effort has been focused on controlling the overpopulation of stray dogs in

India, less attention has been given to addressing reproductive failures in the pet population, where high levels of inbreeding are common (Ayandele*et al.,* 2020). Infertility in female dogs can stem from structural issues (congenital or acquired, including tumors), functional problems (such as hormonal imbalances), infections, or poor management. Infectious causes include conditions like brucellosis, canine herpesvirus, neosporosis, toxoplasmosis, and bacterial infections from organisms such as *Escherichia coli*, *Staphylococcus aureus*, and *Klebsiella spp*., all of which can interfere with normal pregnancy. These infections may be contracted during estrus, through mating, from the environment, or via systemic infection. Uterine infections like endometritis, pyometra, and metritis also contribute to infertility (Hensel *et al.,* 2018). Brucellosis, caused by Brucella species *(B. canis, B. abortus, B. melitensis, and B. suis*), is a significant infectious disease affecting canine reproduction, leading to infertility, reproductive failure, and abortion, with a higher prevalence among stray dogs than pets. Although infected dogs may not show overt symptoms, brucellosis can terminate their breeding potential, resulting in substantial financial losses for breeders (Hensel *et al.,* 2018). Dogs that test positive for Brucella should not be used for breeding. Diagnosing canine brucellosis remains challenging for veterinarians, despite the availability of more accurate tests. Brucellosis also carries serious public health implications due to its zoonotic nature. Given that India is endemic for bovine brucellosis, there is a heightened risk of transmission from ruminants to dogs (Ranjalkar and Chandy, 2019).

2.1. Normal Genital Bacterial Flora in Dogs

In healthy bitches, the vestibule and vagina are naturally populated by a variety of aerobic and anaerobic bacteria. The bacterial flora in these areas consists of a mix of both types. Common aerobic bacteria found in normal bitches include *E. coli, Staphylococcus spp.*, and *Streptococcus spp.*, while anaerobic bacteria such as *Bacteroides spp.* and *Pepto streptococcus spp.* are also present (Münnich*et al.,* 2000). According to Kustriz, (2003), bacterial agents like *Brucella spp., E. coli , Proteus vulgaris, Pseudomonas spp., Staphylococcus spp., and Streptococcus spp.* are responsible for causing orchitis and epididymitis in male dogs.

2.2. Infertility in Female Dogs

Infertility refers to the inability to conceive and produce viable offspring and can occur at any stage of a bitch's reproductive cycle. This can be due to failure to mate, unsuccessful conception, or early pregnancy loss (Okkens, 1994). In polytocous species like dogs, subfertility, or having smaller-than-expected litter sizes, is also considered a form of infertility. Typically, a healthy bitch is expected to reach sexual maturity by 24 months and experiences an estrus cycle every 4.5 to 10 months (Feldman and Nelson, 1996). Even with proper diagnosis and treatment, fertility is restored in only about 10% of cases, and the prognosis for infertility is often poor (Johnston *et al.,* 2001). Grundy *et al.,* (2002) suggested that poor breeding management is often the main cause of perceived infertility, rather than an inability to conceive.

3. Canine Brucellosis

Brucella canis was isolated for the first time by Carmichael (1966). It was the first report of a new contagious reproductive disease in dogs, which occurred in New Jersey in 1966. The main clinical feature of the disease was abortion during the last trimester of pregnancy without premonitory signs in Beagle bitches maintained in colonies. Taul et al. (1967) and Carmichael and Kenney (1968), indicated that an unusual reproductive disease was observed by dog breeders in 1962 and that the suspected etiologic agent had been isolated as early as 1965 which was closely related to Bordetella and Brucella. Faigel (1969) used the term "Beagle fever" for canine brucellosis as it was first isolated in USA from large commercial breeding kennels and in packs of field dogs, mainly beagles. Deyoe (1970) proposed the name Brucella canis for the newly identified bacteria. The Center for Food Security and Public Health (CFSPH, 2012) reviewed that canine brucellosis could end the reproductive life of a breeding animal. Dentringer et al. (2015), highlighting the relevance of canine brucellosis as an emerging urban zoonosis. Weese et al. (2020) reported that the dog-adapted brucella species could be carried sub clinically for a long-term and mostly caused reproductive diseases and disk spondylitis in dogs.

3.1 Etiology

Canine brucellosis is primarily caused by *Brucella canis*, a small, rough, Gram-negative intracellular bacterium that appears as coccobacilli or short rods. Occasionally, other species of Brucella, such as *B. abortus*, *B. suis*, and *B. melitensis*, have been known to infect dogs. Unlike these species, which are pathogenic to humans and form smooth colonies, *B. canis* naturally forms rough colonies. Most Brucella species grow aerobically, although some, like *B. abortus*, may require 5–10% carbon dioxide for initial isolation. High-quality peptone-based media enriched with blood or serum supports their growth in vitro, but the process is slow, sometimes taking up to four weeks for initial isolation. Brucella species can be readily isolated from blood and bone marrow, and B. canis is frequently found in canine testes (Sheftel, 2003).All Brucella strains are catalase-positive, but their oxidase, urease, and hydrogen sulfide production may vary, *B. canis* has been identified as a leading cause of infertility in domestic dogs, particularly in breeding kennels worldwide (Hollett, 2006).

3.2 Isolation and Identification of *B. Canis*

Brucella canis can grow on standard culture media such as tryptose agar and does not require carbon dioxide for growth. Antigenically, it is classified as a rough Brucella due to its outer membrane lipopolysaccharide, which gives colonies a rough appearance after 48 hours of growth (Wanke, 2004). The bacterium is facultatively intracellular, non-motile, non-encapsulated, non-spore-forming, and appears as Gram-negative coccobacilli or short rods, which are characteristic of the Brucella genus. Timoney *et al.,* (2009) observed that B. canis only forms rough or mucoid colonies and, unlike other Brucella species, is inhibited by 10% carbon dioxide. It does not utilize erythritol as a preferred nutrient, produces a large amount of urease, and does not generate hydrogen sulfide. Both *Brucella ovis* and *B. canis*have rough lipopolysaccharides (RLPS) in their outer cell walls, whereas other species possess smooth lipopolysaccharides (SLPS) (Nielsen and Yu, 2010). The growth of B. canis is slow, with colonies taking 2 to 3 days to mature. After prolonged incubation, the initially translucent colonies become highly mucoid or ropy in broth. Mature colonies typically measure 1 to 1.5 mm in diameter, with the mucoid nature being a distinctive feature of B. canis. Its growth patterns on thionine and basic fuchsin resemble those of *B. suis*, and the organism is weakly oxidase-positive, reduces nitrate, and is not lysed by phage Tb (Carmichael, 2018).

3.3 Epidemiology

In India, the first report of *Brucella canis* infection in dogs was that of (Pillai *et al.,* 1991) from Small Animal Clinic of the Madras Veterinary College, Chennai. One of the dogs was infected with a rough strain derived from Brucella suis biovar 1. This study also found a 2.18% prevalence of canine brucellosis in Tamil Nadu, as determined by the mercaptoethanol test (MET) using *B. canis* antigen on 640 dogs. These findings were confirmed by Srinivasan et al., (1992), who conducted a similar serological survey of 460 dogs, revealing a 2% prevalence rate. Historically, *B. canis* infection was associated with Beagles, largely because of their use in research and field trials. However, other breeds, such as Labrador Retrievers, Cocker Spaniels, German Shepherds, Golden Retrievers, Lhasa Apsos, Dachshunds, Chihuahuas, and Pomeranians, are also affected.

3.4 Sources of Infection:

The most common transmission routes of *Brucella canis* include ingestion or inhalation via oronasal or conjunctival contact with aborted materials. The highest concentration of *B. canis*organisms is found in vaginal discharges, which serve as a major infection source after abortion. Though transmission via fomites is possible, *B. canis* is easily inactivated by common disinfectants (Kustriz, 2003). According to Baek *et al.,* (2003), *B. abortus* organisms can persist in vaginal discharges for up to 42 days post-abortion/parturition, indicating the potential for long-term infectivity. Transmission of *B. abortus* in dogs is linked to contact with infected cattle, and both horizontal and interspecies transmission have been documented, including dog-to-dog, dog-to-human, and dog-to-cattle (Wanke, 2004).

3.5 Pathogenesis

Once *Brucella canis* enters the body through exposed mucous membranes, it attaches to and penetrates the tissue, where it gets phagocytosed by host cells. The bacteria then travel to the lymph nodes, where they replicate and initiate bacteraemia within 7 to 30 days (Hollett, 2006). B. canis causes intracellular infections primarily in the reproductive system and the reticuloendothelial system, including mononuclear cells in the liver, spleen, lymph nodes, bone marrow, and kidneys. In males, B. canis targets steroid-dependent tissues such as the prostate, testicles, and epididymis, leading to testicular atrophy, teratozoospermia, and sperm agglutination due to antisperm antibodies and delayed hypersensitivity reactions (Johnston *et al.,* 2001). In females, the bacteria affect the foetus, gravid uterus, and placenta. Pups can be infected in utero, with bacteria detected in foetal stomach contents, likely due to the ingestion of amniotic fluid (Serikawa *et al.,* 1978). The non-gravid, diestrual uterus is not a preferred site for replication (Kustriz, 2003). In pregnant bitches, *B. canis* primarily targets trophoblasts, with heavily infected trophoblasts showing infiltrates of neutrophils and mononuclear cells in aborted placentas (Gyuranecz*et al.,* 2011). The bacteria suppress host bactericidal mechanisms by inhibiting tumor necrosis factor-α, natural killer cells, and macrophages (Greene and Carmichael, 2012).

3.6 Clinical Signs

Canine brucellosis has been labelled "The Great Imposter" (Bramlage *et al.,* 2015) because its symptoms closely resemble those of various other diseases. These symptoms include poor coat

condition, lethargy, fatigue, lameness, reduced athletic performance, weight loss, back pain, vision problems, and behavioral changes (Beehan, 2017). The signs of Brucella infection are not specific, making diagnosis challenging. Late-term abortions are marked by a brown or grey-green vaginal discharge lasting from 1 to 6 weeks, and aborted pups often show signs of autolysis, indicating that they died before being expelled (Kustriz, 2003).Brucellosis does not typically alter the estrus or breeding patterns in bitches. Reproductive issues include failure to conceive, difficulty whelping, and late-term abortions without clear cause, ultimately leading to infertility (Hollett, 2006). Neurological symptoms like behavioral changes, anisocoria, ataxia, and head tilting can appear within three weeks after the initial breeding. Chronic pyogranulomatous dermatitis resembling lick granuloma has also been reported (Carmichael and Greene, 2012).

3.7 Diagnosis

In dogs, the diagnosis of infections caused by *Brucella abortus*, *B. melitensis*, and *B. suis* can follow the same procedures used for cattle, although ELISA is not commonly used in canine diagnostics (Corbel, 2006). Immunohistochemistry offers an alternative method for directly diagnosing Brucella infections, with the advantage that it does not require viable bacteria and facilitates retrospective studies (Gerusu and Kassa, 2016). Carmichael, (2018) suggests that canine brucellosis should be included in the differential diagnosis when there is a history of poor reproductive performance or abortion in bitches. Despite using multiple tests, diagnosing canine brucellosis caused by *B. canis* remains challenging, as demonstrated by Mol *et al.,* (2020). Smears from placental tissue, vaginal discharge or foetal stomach contents was stained using modified Ziehl-Neelsen (Stamp) or Kosters' methods. The presence of large aggregates of intracellular, weakly acid-fast organisms with brucella morphology was presumptive evidence of brucellosis (Corbel, 2006).

3.7.1Culture Methods

Hollett (2006) indicated that simply testing positive for Brucella on one test was not enough for a definitive diagnosis, as euthanasia was considered for infected dogs. Isolation of the bacteria was necessary for confirmation, but this process was time-consuming, often taking 10 days or more. According to Keid *et al.,* (2007), the extended period of bacteremia caused by B. canis made blood samples the preferred choice for isolating the microorganism. *Brucella canis* was cultured directly from genital samples, such as vaginal swabs and semen, on tryptose agar plates with antibiotics, and identification was based on morphological, cultural, and biochemical characteristics (Keid *et al.,* 2009). Samples such as semen, vaginal secretions, and urine (if not collected by cystocentesis) were often contaminated with other organisms, making placenta, lymph nodes, prostate, and spleen better choices for culture (Graham and Taylor, 2012). Vaginal swabs, semen, placentas, dead fetuses, and neonates were valuable for detecting infection even after bacteremia resolution (Taques*et al.,* 2016). Culture of aborted fluids/tissues, blood, semen, vaginal discharge, or urine was considered the gold standard for diagnosing B. canis .Although bacterial culture was the ideal confirmatory test, a negative result should not completely rule out infection (Cosford, 2018).

3.7.2 Serological Testing

All smooth species of Brucella (such as *B. abortus*, *B. melitensis*, and *B. suis*) contain a smooth lipopolysaccharide (SLPS) and an immunodominant O-polysaccharide (OPS), which are absent in *B. ovis* and *B. canis*. These smooth species share common epitopes in the OPS, which is why serological tests for these bacteria typically use *B. abortus* antigens in the form of whole cells, SLPS, or OPS. In contrast, rough lipopolysaccharide (RLPS) is used to detect antibodies against B. ovis and B. canis (Nielsen, 2002). For diagnosing canine brucellosis, (Keid *et al.*, 2009) compared the sensitivity and specificity of the Agar gel immunodiffusion test (AGID) and the Rapid slide agglutination test (RSAT) against microbiological culture and PCR. The diagnostic sensitivities were 70.58% for RSAT, 31.76% for 2ME-RSAT, and 52.94% for AGID, with diagnostic specificities of 83.4% for RSAT, 100% for 2ME-RSAT, and 100% for AGID. Since *B. canis* shares antigens with B. ovis and B. abortus RB51 strain, these strains can be used as antigens. (Escobar *et al.*, 2010) recommended RSAT for screening and IELISA for confirmation. Nielsen and Yu, (2010) noted that no test was 100% accurate, so a combination of a highly sensitive screening test followed by a specific confirmatory test is generally used. Tests measuring IgM were less desirable, with assays predominantly measuring IgG1 being more effective. Sanchez-Jimenez *et al.,*(2020) recommended an indirect ELISA (iELISA) to detect antigen-specific IgG or IgM antibodies as a confirmatory test.
The most commonly used tests include:

3.7.3 Rose Bengal Plate Test (RBPT)

The Rose Bengal Plate Test (RBPT) is a rapid, cost-effective, sensitive, and highly specific assay capable of detecting antibodies early in infection (Kustriz, 2003). To perform the RBPT, a drop of the RBPT reagent is mixed with an equal volume of serum on a glass plate, and the results are read after two to four minutes. While the RBPT demonstrates high sensitivity (>99%), its specificity may be notably low (Smits and Kadri, 2005). This simple spot agglutination test is effective for diagnosing bovine brucellosis when used as a screening method, as it detects all three major anti-brucella immunoglobulin isotypes (IgM, IgG1, and IgG2). Negative results on the RBPT may suggest that the cattle are brucellosis-free; however, sera that test positive should be further confirmed using a definitive test, typically the complement fixation test (CFT) (Corbel, 2006). According to Holst *et al.*, (2012), the main limitation of the RBPT is its potential for false positives. The incidence of false positives can be reduced by treating the samples with 2-mercaptoethanol (2-ME), which dissociates IgM and allows only IgG to be detected. A negative result after adding 2-ME indicates that the initial positive result was either a false positive or that the dog is in the early stages of infection with B. canis, where only IgM is present. The 2-mercaptoethanol rapid slide agglutination test (RSAT; ME-RSAT) is preferred for screening due to its affordability, speed, and sensitivity (Greene and Carmichael, 2012).

3.7.4 Serum Tube Agglutination Test (STAT)

The Serum Tube Agglutination Test (STAT) identifies IgM and IgG2 but is not a standard test for diagnosing brucellosis because it does not detect IgG1 (Corbel, 2006). The Tube Agglutination Test (TAT) for *B. canis* can detect antibodies in the serum and offers quantitative results; samples with titres below 1:200 should be re-evaluated in two weeks (Makloski, 2011). Animals testing positive on the STAT should be further examined using Complement Fixation Test (CFT) or ELISA before culling. If

the animal is healthy or in the early stages of infection, the STAT may be negative as no agglutination would occur at a 1:50 serum dilution. If the test shows incomplete or complete agglutination at dilutions of 1:50 or 1:100, or incomplete agglutination at 1:200, the animal may be in the early stages of infection or there might be a false positive. A positive reaction with complete agglutination at a 1:200 dilution or higher suggests a potential infection, and a follow-up serum sample should be collected 30 days later for retesting (Carmichael, 2018).

3.7.5 Agar Gel Immunodiffusion Test (AGID)

The Agar Gel Immunodiffusion (AGID) test is a highly sensitive method for detecting *B. canis*, utilizing either cell wall antigens (somatic, sAg) or cytoplasmic antigens (cAg). The cytoplasmic antigen is particularly specific to *B. canis* infections and serves as a confirmatory test for dogs that test positive with RSAT or TAT (Kustriz, 2003). For suspected chronic infections, the AGID test is recommended as it often yields more positive results compared to other tests (Holst *et al*., 2012).

3.7.6 Enzyme-Linked Immunosorbent Assay (ELISA)

In brucellosis, specific IgM antibodies are predominant during the acute phase of the disease, while specific IgG antibodies appear later and in cases of relapse. ELISA is utilized to differentiate between IgM and IgG antibodies and to estimate the stage of the illness (Smits and Kadri, 2005). According to Corbel, (2006), ELISA tests are relatively straightforward, providing excellent sensitivity and specificity, with numerous commercial kits available. However, ELISAs offer only marginally higher specificity compared to the Rose Bengal Plate Test (RBPT) or Complement Fixation Test (CFT).

3.7.7 Immunochromatography Test (ICT)

(Kim *et al.,* 2007) introduced the immunochromatographic assay (ICA), a simplified and rapid alternative to ELISA. For diagnosing canine brucellosis, (Keid *et al.,* 2015) noted that ICT demonstrated higher diagnostic specificity and sensitivity compared to RSAT, 2ME-RSAT, and AGID, although it was not sensitive enough to serve as a screening test. The lateral flow immunochromatography test is straightforward and easy to perform. The sensitivity of this test for detecting brucella IgM/IgG was reported at 95%, with a specificity of 97% (Gupte and Kaur, 2015).

3.7.8 Molecular Detection methods

(Leal-Klevezas*et al.,* 1995) compared traditional serological and microbiological methods with polymerase chain reaction (PCR), demonstrating that PCR was superior for detecting small quantities of the pathogen in body fluids of infected animals. They used genes coding for the outer membrane protein (omp-2) of *Brucella spp*. and concluded that PCR was reliable, highly sensitive, and specific for accurate detection of *Brucella spp.* Baek *et al.,* (2003) confirmed the presence of *B. abortus* in Korean dogs using the AMOS (Abortus Melitensis Ovis Suis) PCR method.

3.7.9 Semen Examination

In cases of male infertility, collecting and examining semen can help identify conditions such as oligozoospermia, teratozoospermia, or azoospermia in the ejaculate (Hollett, 2006). Davidson and Sykes, (2014) noted that common morphological abnormalities associated with brucellosis include detached sperm heads, acrosomal deformities, and proximal or distal cytoplasmic droplets. Additionally, sperm head-to-head agglutination may indicate the presence of anti-sperm antibodies.

3.8 Treatment

Johnston *et al., (*2001) recommended neutering and housing pet animals that test positive for Brucella individually. To reduce bacteraemia and subsequent shedding of the bacteria, treatment with antibiotics should be continued. Suggested regimens included minocycline (25 mg/kg orally once daily for 14 days), dihydrostreptomycin (5 mg/kg intramuscularly twice daily for 7 days), tetracycline (30 mg/kg orally twice daily for 21 days), and streptomycin (20 mg/kg intramuscularly once daily for 14 days). Kustriz, (2003) described a combination therapy involving streptomycin (20 mg/kg intramuscularly once daily for the first two weeks) with minocycline or doxycycline (25 mg/kg orally once daily for 4 weeks or 12.5 mg/kg orally twice daily for 4 weeks). Treatment of brucellosis remains challenging due to many antimicrobials failing to achieve adequate intracellular concentrations. Combination therapies, such as tetracyclines with aminoglycosides or fluoroquinolones with aminoglycosides, were noted as more effective (Wanke, 2004; Ledbetter *et al.,* 2009). Wanke, (2004) reviewed four treatment protocols for managing canine brucellosis: oral tetracycline (30 mg/kg) twice daily for 28 days combined with intravenous streptomycin (20 mg/kg) once daily for 14 days; oral tetracycline (30 mg/kg) three times a day for 30 days with intramuscular streptomycin (20 mg/kg) on days 1–7 and 24–30; minocycline (10 mg/kg) twice daily combined with intramuscular streptomycin (4.5 mg/kg) for 7 days; and long-acting oxytetracycline (20 mg/kg intramuscularly) once a week for 4 weeks, with daily streptomycin injections for the first 7 days.

3.9 Prevention and Control

(Wanke, 2004) noted that puppies born to bitches with chronic brucellosis were often infected and could spread the bacteria after reaching puberty. It was advised to avoid breeding dogs that test positive, even if they have high genetic value. Routine serological testing of all male and female dogs before mating is recommended. For kennels with a history of brucellosis, serologically negative dogs should receive treatment with tetracycline and streptomycin for one month. Any new positive cases should be isolated, and monthly control measures should be implemented until no positives are detected for three consecutive months. Brucella bacteria are susceptible to disinfectants such as 1% sodium hypochlorite, 70% ethanol, iodine/alcohol solutions, glutaraldehyde, and formaldehyde. These disinfectants can be used to clean facilities and equipment to reduce disease spread (Hollett, 2006).Makloski, (2011) recommended quarantining all newly purchased or imported dogs in a kennel for 8 to 12 weeks and ensuring they test negative for brucellosis before release. Regular testing of all kennel dogs twice a year is advised, with testing during the female's heat cycle and every six months for males. Breeding animals should be serologically tested 3 to 4 weeks before mating, and those showing clinical signs of brucellosis should be excluded. Dogs from kennels with known breeding issues should be rejected unless test results are negative. Newly purchased animals should be

quarantined until they have two consecutive negative serotest results at one-month intervals (Greene and Carmichael, 2012). In endemic areas, breeding animals should be tested annually. Prevention and control involve strict biosecurity measures, staff and client education, personal hygiene, proper disposal of infected materials, use of personal protective equipment, and routine disinfection with 2.5% sodium hypochlorite, quaternary ammonium compounds, or 70% ethanol with a minimum of ten minutes contact time (Cosford, 2018).

3.9.1 Public Health Significance

Wanke, (2004) noted that the true incidence of canine brucellosis in humans was not well-documented due to the nonspecific nature of clinical signs, which made diagnosis difficult. The infection is typically transmitted through direct contact with infected animals or occupational aerosol exposure. Symptoms of the disease include prolonged fever, swollen lymph nodes, pharyngitis, joint pain, shivering, and weight loss. Brucellosis, also known as undulant fever, Mediterranean fever, or Malta fever, is a zoonotic disease with rare instances of person-to-person transmission through blood donation, tissue transplantation, bone marrow transfer, or contact with laboratory workers handling patient samples. Hensel *et al., (*2018) observed that neither the World Health Organization (WHO) nor the World Organisation for Animal Health (OIE) had specific policies for controlling brucellosis in dogs. Many countries, including India, lack routine monitoring and surveillance programs for canine brucellosis. Alamian and Dadar, (2020) isolated B. melitensis , a potent zoonotic agent, from herding dogs in Iran, highlighting the need for systematic screening and epidemiological investigations on canine brucellosis in companion animals.

4.0 Conclusion

India faces a significant challenge with bovine brucellosis, which also poses a public health risk. The growing stray dog population and inadequate disposal of slaughterhouse waste, including aborted placenta and fetuses, may exacerbate brucellosis cases in dogs, particularly those caused by Brucella abortus. Therefore, it is advisable to screen all dogs in breeding kennels regularly, especially before mating. Although the Rose Bengal Plate Test (RBPT) is recognized as a standard serological test for bovine brucellosis, its use in dogs is recommended. Bitches with issues such as infertility, conception failure, or a history of abortion should be tested for brucella infection, with confirmatory tests like PCR using specific primers. Management practices, such as feeding dogs raw meat and milk, might contribute to the spread of brucellosis. Some breeders mistakenly believe that raw meat enhances dogs' wild traits and vitality, not realizing that it can increase the risk of zoonotic diseases. All aborted materials, including placenta and fetuses, should be handled with care using personal protective equipment. Non-reproductive signs of brucellosis, such as discospondylitis, chronic recurrent uveitis, and lameness, should also prompt screening for the disease.In summary, regular screening for brucellosis is essential for all dogs of reproductive age. Urogenital infections should be treated with antibiotics only when necessary and based on culture and sensitivity results. Dogs that test positive for brucella should be excluded from breeding programs. Although euthanasia is recommended in many countries with endemic canine brucellosis, in India, where pet-owner bonds are strong, neutering or castrating affected dogs is advised instead, even if they have high genetic value.

4.1 Future Perspective

Diagnosing Brucella canis infection presents significant challenges. While dogs are the primary hosts for B. canis, infections with other Brucella species, such as *B. suis* (Frost, 2017). and B. abortus (Wareth, *et al.,* 2018) can also occur. Therefore, developing effective and precise diagnostic methods specific to B. canis is crucial. Currently, controlling and preventing canine brucellosis is difficult, largely due to the challenges in identifying infected dogs, which hinders efforts to prevent the disease's spread. In this context, there is a strong need for new diagnostic methods and effective, safe vaccines. These advancements would represent significant progress in managing canine brucellosis. Additionally, increasing awareness among healthcare professionals about the impact of human brucellosis linked *to B. canis* could lead to improved understanding and better therapeutic interventions, ultimately reducing the adverse effects of the disease.

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