

EPIDEMIOLOGICAL STUDY OF BRUCELLOSIS IN DOMESTIC ANIMALS

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Abstracts: Brucellosis is a disease that causes severe economic losses for livestock farms worldwide. *Brucellamelitensis*, *B. abortus* and *B. suis*, which are transmitted between animals both vertically and horizontally, cause abortion and infertility in their primary natural hosts – goats and sheep (*B. melitensis*), cows (*B. abortus*) and sows (*B. suis*). *Brucella* spp. infects not only their preferred hosts but also other domestic and wild animal species, which in turn can act as reservoirs of the disease for other animal species and humans. Brucellosis is therefore considered to be a major zoonotic disease that are transmitted by direct contact with animals and/or their secretions, or by consuming milk and dairy products.

Keywords: *Brucella abortus* – *Brucellamelitensis* – *Brucella suis* – Brucellosis – Epidemiology

Introduction

The main characteristic features of the *Brucella* genus is its ability to survive within phagocytic and non-phagocytic cells. While a wide variety of factors explain the capacity of the *Brucella* genus to multiply and spread to new cells, so far no single factor has been shown to be responsible for its virulence (Celli *et al.*, 2004).

Brucellae usually enter in the body via the oral route and lodge in the mucosa, where the bacteria are ingested by professional phagocytes beneath the sub-mucosa. Once internalised, *Brucella* is localised in a vacuole that matures from an early to a late endosome and, unless destroyed, goes on to multiply in the endoplasmic reticulum of macrophages. These bacteria multiply abundantly in the placental cotyledons, chorion and fetal fluids, where they cause lesions in the organ wall, inducing endometriosis ulcerosa in the intercotyledonary spaces and destruction of the villi, leading to death and expulsion of the fetus (Xavier *et al.*, 2009). Three species of *Brucella* affect humans: *B. melitensis*, *B. abortus* and *B. suis* (other species can cause infection in humans, but only rarely). Out of these three species, infections by *B. melitensis* are the most common in humans (Pappas *et al.*, 2005).

Epidemiology of *Brucella abortus*

Bovine brucellosis is usually caused by *B. abortus*. *Brucella abortus* has seven recognized biovars, the most reported of which are biovars 1, 2, 3, 4 and 9. The primary source of

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infection for cattle is believed to be elk (*Cervuselaphus*) (Van Campenet *al.*, 2010). Ruminants are generally susceptible to *B. abortus*, which is of particular relevance in areas where eradication programmes are in operation. Buffaloes, camels, deer, goats and sheep are highly susceptible to infection (Cvetnicet *al.*, 2005). The manifestations of brucellosis in these animals are similar to those of bovine brucellosis and can become epidemiologically important in sustaining the infection in cattle where they share pasture and water holes (Centers for Disease Control and Prevention CDC., 2011). The infection is prevalent in horses cohabiting with cattle, it presents with characteristic swelling of the supraspinous bursa, known as fistulous withers. The infection is usually transmitted to pigs by feeding them whey as a by-product from cheese-making (Muñoz *et al.*, 2010; Musa M.T. & Jahans K.L. 1990). The main route of entry for *Brucellais* oral, by the ingestion of food or water contaminated with secretions or aborted fetal remains from infected cows, or by licking the vaginal secretions, genitals, aborted fetuses or newborn calves of infected cows. Infected cows shed *Brucellain* their milk and this is key in its transmission to calves.

The disease is usually asymptomatic in non-pregnant females, but pregnant adult females infected with *B. abortus* develop placentitis, which normally causes abortion between the fifth and ninth month of pregnancy. Adult males can develop orchitis, and brucellosis can cause sterility in both sexes. Neutered males used for fattening are not important in the distribution of the disease (Samartino L. 2003; Carvalho Neta, 2010; World Organisation for Animal Health (OIE), 2010).

Epidemiology of *Brucellasuis*

Domestic pigs are mainly infected by *B. suis*. There are five biovars of *B. suis*, with 1, 2 and 3 being responsible for porcine brucellosis worldwide. *Brucellasuis* biovars 1 and 3 are distributed worldwide in most areas where there are pigs. They affect both sexes, causing infertility, abortion, orchitis and bone and joint lesions.

Brucellasuis is moderately influenced by environmental factors, the bacteria often survive desiccation and can survive freezing temperatures for over two years (Public Health Agency of Canada (PHAC), 2009).

The *B. suis* entry sites are similar to those identified for other types of *Brucellain* infection, being essentially the oral, nasopharyngeal, conjunctival and vaginal mucosa. These are not usually visible in young animals, and their occurrence will depend mainly on the age, sex and physiological state of animals at the time they are infected.

In a primary infection with *B. suis* in pig farms, the bacteria can spread within a few months from one infected pig to more than 50% of animals on the farm. The infection can often reach 70% to 80% of infected animals at the start of the outbreak (Philippon et al., 1970; Beer J. 1980). However, recently infected herds may manifest major signs of infection, such as a high percentage of abortions, increased neonatal mortality and infertility, causing adverse economic consequences. Porcine brucellosis is believed to affect both sexes equally and age is no determinant of susceptibility, although this is not proven. It has also been reported that some pig breeds, such as Duroc and Jersey Red crosses, may be less susceptible to experimental challenge with *B. suis*, which suggests the existence of genetic resistance to infection (Cameron et al., 1942).

Brucellosis infection caused by *B. suis* biovar 2 differs from that caused by biovars 1 and 3 in terms of geographical distribution, host and virulence, and is considered less pathogenic for humans than the highly infectious biovars 1 and 3; humans must be immunocompromised to become infected with biovar 2 (Garin-Bastuji et al., 2006; Lagier, 2005; Meirelles-Bartoli et al., 2012).

Epidemiology of *Brucella melitensis*

Brucella melitensis is the most virulent species of the *Brucella* genus and has three biovars, with biovars 1 and 3 being the ones isolated most frequently in small ruminants (Lucero et al., 2008; Blasco J.M. & Molina-Flores B. (2011). Brucellosis causes significant losses from abortion, as well as being a serious zoonosis (Banai M. 2007; Benkirane A. 2006; Seleem et al., 2010).

Goats are the classic and natural host of *B. melitensis* and, together with sheep, are its preferred hosts. The main clinical manifestations of brucellosis in ruminants are abortion and stillbirths, which usually occur in the last third of the pregnancy following infection and usually only once in the animal's lifetime (Blasco J.M. & Molina-Flores B. 2011; Elzer et al., 2002). *B. melitensis* can be transmitted congenitally *in utero* but only a small proportion of lambs and kids are infected in this way and most latent infections of *B. melitensis* are probably acquired by ingesting colostrum or milk (Grillo M.J., Barberán M. & Blasco J.M. 1997). It is therefore recommended that infected females and their offspring be culled as part of an eradication programme in infected herds (Banai M. (2007). The exact mechanism enabling latent *Brucella* infection to develop is unknown (Blasco J.M. & Molina-Flores B. 2011).

Some female hoggets testing seropositive to brucellosis have been found to shed *B. melitensis* in milk postpartum, whereas others do not shed brucellae despite being infected. A previously unreported fact is that *B. melitensis* was successfully isolated from the vaginal discharge of a goat that had aborted but tested seronegative for brucellosis, making the animal a potential risk for spread undetectable by serological diagnosis (Herrera *et al.*, 2011).

While orchitis and epididymitis are uncommon in rams and billy goats, they do occur (Chand P., Sadana J.R. & Malhotra A.K. 2002). *Brucellamelitensis* biovar 3 has been isolated from a testicular hygroma of a ram (Musa M.T. & Jahans K.L. 1990). *Brucellamelitensis* can infect not only cattle but also calves, through the ingestion of infected milk. The isolation of *B. melitensis* in dogs has been demonstrated and this has been observed to favour incidence of the disease, as dogs can drag placentas or aborted fetuses to uninfected areas.

In extensive goat and sheep farms, it is common practice for herds to share pasture and water holes before returning to their pens. Such mixing of animals is a factor of risk for spreading the disease from infected to free herds and makes it harder to control. In this case, all goats sharing such sites must be considered as a single, large herd, and all goat farmers must carry out control activities, e.g. vaccination and the separation of positive and negative animals.

Conclusion

Any strategy for the control or eradication of brucellosis in domestic animals should be begun by establishing the different epidemiological contexts within a country or even a region or district, and must have the support and collaboration of farmers. Above all, the effectiveness of any such strategy will rely heavily on the quality of the Veterinary Services and administrative organizations involved, because the requisite diagnostic and prophylactic tools are already fully validated and standardized.

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