Brucellosis in Brazil

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Abstract

This paper reviews the epidemiology of bovine, swine, ovine, caprine, and canine brucellosis in Brazil. The zoonotic aspects of Brucella infection in Brazil is also discussed. Emphasis is given to the new program for the control of brucellosis in cattle and buffaloes that is likely to provide important insights into the prospects and strategies for controlling brucellosis in developing countries. © 2002 Elsevier Science B.V. All rights reserved.

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1. Introduction

According to the Food and Agriculture Organization (FAO), the World Health Organization (WHO) and the Office International des Epizooties (OIE), brucellosis is still one of the most important and widespread zoonoses in the world.

Brucellosis was first detected in Brazil in 1913 by Gonçalves Carneiro, who reported a case of human brucellosis (Veronezi, 1976). Since then, several epidemiological surveys have revealed the presence of the disease in the livestock population countrywide (Garcia-Carrillo, etc.)
1987). Bovine brucellosis due to *Brucella abortus* is the most prevalent *Brucella* infection in Brazil, followed by *B. suis* in pigs. *B. melitensis* and *B. neotomae* were never isolated in the country. The economic impact of bovine brucellosis in Brazil has been estimated at 32 millions dollars annually (Brazil, 1971).

Brazil has the largest commercial cattle population in the world with 159.3 million head distributed in 2.5 million holdings that cover in excess of 160 million hectares. The human population of Brazil is estimated at just under 170 million. Table 1 displays the distribution of the livestock population across Brazil's geographical regions (Brazil, 2000).

The geographical, economical and social conditions account for the existence of very different livestock production systems across the country (Fig. 1). In the north and northeast regions, and in the northwestern part of the midwestern region, cattle are scattered with a density below one animal per hectare. In the southern and southeastern regions and in the eastern part of the midwestern region, cattle production is more intensive with a density above one head per hectare (Brazil, 2000). The zebu breeds predominate in the national beef population, with the exception of the south where European breeds are more common. There is also a growing presence of cross breeds of zebu and European stock.

According to the Ministry of Agriculture (Brazil, 2000), dairy herds account for 20% of the total cattle holdings. Dairy production is concentrated in the southern and southeastern regions, which account for 69% of the national milk production. A great expansion of this activity was recently seen in the midwestern region, which increased its milk production by 50% from 1990 to 1996 and currently accounts for 14.4% of the national milk production. In 1999, the total milk production was 19 billion litres, a 39% increase within a decade (Brazil, 2000).

### 2. Epidemiology

#### 2.1. Bovine brucellosis

Previous studies revealed that bovine brucellosis was widespread throughout the country. In 1977, a national survey showed the following animal prevalence for each

<table>
<thead>
<tr>
<th>Region</th>
<th>Area (km²)</th>
<th>Total number of animals by species</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Cattle</td>
</tr>
<tr>
<td>Midwest</td>
<td>1,619,805</td>
<td>55,883,282</td>
</tr>
<tr>
<td>Northeast</td>
<td>1,552,614</td>
<td>20,348,823</td>
</tr>
<tr>
<td>North</td>
<td>3,860,069</td>
<td>23,383,630</td>
</tr>
<tr>
<td>Southeast</td>
<td>924,340</td>
<td>36,306,478</td>
</tr>
<tr>
<td>South</td>
<td>574,461</td>
<td>23,404,857</td>
</tr>
<tr>
<td>Total</td>
<td>8,531,289</td>
<td>159,327,070</td>
</tr>
</tbody>
</table>
A few regional surveys revealed that the picture has not changed much since then. In the State of Rio Grande do Sul as a result of a successful vaccination program, animal prevalence dropped from 2.0% in 1977 to 0.3% in 1986. In Santa Catarina, there was an increase from 0.2% in 1977 to 0.6% in 1996. In Mato Grosso do Sul, prevalence was stable between 1977 and 1998, at a 6.3% rate. In Minas Gerais, the biggest dairy state in Brazil, the prevalence dropped from 7.6% in 1977 to 6.7% in 1980 (Castro, 1982). According to official reports, the prevalence of bovine brucellosis in Brazil ranged from 4 to 5% in the period of 1989–1998 (Brazil, 2001a). Major prevalence and exploratory surveys are underway at the moment in most Brazilian states.

Official reporting and survey data show a fairly stable endemic situation and a higher prevalence of the disease in the regions with higher cattle density. It is worth pointing out that bovine brucellosis is highly prevalent in beef herds, as highlighted by the prevalence figures reported for the midwestern region.
Very few studies have been dedicated to the investigation of the different biovars of *Brucellae* among Bovidae in Brazil. Nevertheless, some studies have revealed that biovars 1, 2 and 3 of *B. abortus* have been isolated (Garcia-Carrillo, 1987). Giorgi et al. (1972) isolated 23 strains of *Brucella* spp. from cattle, pigs and horses, and 1 strain from cattle was *Brucella suis*, 7 were *B. abortus* biovar 1 and 9 *B. abortus* biovar 2. Langenegger et al. (1975) isolated 4 strains of *B. abortus* biovar 1 and 6 of *B. abortus* biovar three from bursa of cattle from slaughterhouses. Poester (1974) isolated *B. abortus* biovar 1 from cattle and horses.

Brucellosis due to *B. abortus* in other Bovidae is also encountered in Brazil, particularly in water bufaloes (*Bubalus bubalis*), as revealed by a number of serological surveys (Santa Rosa et al., 1961; Costa et al., 1973; Sandoval et al., 1979).

2.2. Swine brucellosis

Few swine brucellosis surveys have been carried out in Brazil and the economic losses due to the disease have not been accurately determined. A national survey carried out during 1981 in 66,770 serum samples revealed a prevalence of 2.19% (Garcia-Carrillo, 1987).

The intensification and integration of pig production in large industrial clusters has drastically decreased the prevalence of the most important swine diseases in Brazil, notably of brucellosis. The last report of swine brucellosis in Brazil indicated a prevalence of 0.34% (Brazil, 2000). Only *B. suis* biovar 1 was isolated (Caldas et al., 1963; Poester, 1977). The control of brucellosis in pig farms that sell breeding stock is very strict and carried out under official supervision.

2.3. Ovine and caprine brucellosis

Brucellosis in sheep and goats is considered a disease of minor importance in Brazil. As *B. melitensis* is not present in the country, some attention has been given to ram epididymitis caused by *B. ovis*, particularly in the southern states where the sheep industry is more developed. *B. ovis* was firstly isolated in Brazil in 1972 in the State of Rio Grande do Sul (Blobel et al., 1972). More recent studies showed an upward trend in the prevalence of this disease (Ramos et al., 1992a,b; Magalhães Neto and Gil-Turnes, 1996).

2.4. Canine brucellosis

Some references in the literature indicate the presence of *B. abortus* in dogs (Silva, 1949; Batista and Hipólito, 1960–1961). *B. canis* has been detected either through serology (Sandoval et al., 1976; Wald and Fernandes, 1976–1977; Magalhães Neto et al., 1992; Poester et al., 1994) or through bacteriology (Fernandes et al., 1976–1977; Godoy et al., 1977a). The social and economic importance of the disease has not been properly assessed, even though *B. canis* has become more widespread, particularly in big cities where the disease has been reported in commercial breeding kennels (Vargas et al., 1996).
2.5. Human brucellosis

As stated before, the first case of brucellosis reported in Brazil was in a human being in 1993 (Veronezi, 1976). Between 1930 and 1950, a great number of publications described the disease in different states of Brazil (Garcia-Carrillo, 1987). Most cases of human brucellosis were essentially an occupational hazard, occurring primarily amongst abattoir workers and meat processors (Figueiredo, 1985).

The threat to human health caused by B. abortus, as well as by other Brucellae, is likely to be underestimated, considering the inadequacy of the reporting and diagnostic services for human brucellosis.

Over the last decades, several studies have been carried out, especially involving blood donors. Godoy et al. (1977b) found 0.28% reactors out of 9360 blood donors in Minas Gerais. Barufa (1978) found in the state of Rio Grande do Sul that the infection rates were higher in the rural areas, higher in males than in females and in persons aged 20–49 years. It should be noted that the consumption of cheese is very high throughout the country, both in urban and rural areas. Consumption of unpasteurized fresh cheese is very common and is a likely source of infection for humans.

3. Prevention and control

The first attempts to control bovine brucellosis in the country date back to 1940–1950. The proposed measures were restricted to the serological examination of tissues from aborted calves with segregation of reactors and the vaccination with strain 19 (Menezes, 1950; D’Apice, 1954).

After some years and very little progress, new national guidelines were proposed with a view to strengthen control measures. This included vaccination of all heifers with strain 19 and the setting up of brucellosis committees that included government representatives (animal and public health), farmers and meat and milk producers (Vinhos, 1958).

The Ministry of Agriculture of Brazil has issued instructions for brucellosis control since 1944. The Decree 6922/44 stated the identification of all vaccinated animals. After that, several other decrees have addressed the same issue, as well as the regulations for the importation and exportation of animals, regulatory tests prior to animal movements, markets and fairs. In 1976, another decree of the Ministry of Agriculture (23/76) proposed a National Program based mainly on voluntary vaccination of heifers, diagnostics at herd level, and test and voluntary slaughter of reactors. The program was never fully implemented and the epidemiological situation remained stable with high disease prevalence in the most important livestock regions.

Nevertheless, some initiatives from individual state’s animal health authorities should be singled out. In 1965, the State of Rio Grande do Sul (Decree 17217/65) started a progressive vaccination program which achieved 80% coverage of eligible heifers and resulted in significant decrease in brucellosis prevalence (Rio Grande do Sul, 1974). Likewise, the state of Minas Gerais implemented a vaccination program in 1994 (Decree 083/97 and 243/97); so far, vaccination coverage is 75% of eligible heifers and an on-going survey should provide insights into the results of such strategy.
In 2000, the Ministry of Agriculture set out to review the legislation and strategy for controlling brucellosis. Early in 2001, a new National Program was launched with ambitious goals (Brazil, 2001b). The proposed strategy can be summarized as follows:

1. Compulsory vaccination of heifers aged 3–8 months with strain 19;
2. Voluntary accreditation of free herds, in accordance with international standards;
3. Voluntary monitoring of beef herds based on a periodic sampling scheme;
4. Regulatory tests for breeding stock prior to interstate movement and to entrance into livestock fairs/exhibitions;
5. Compulsory slaughter of cattle testing positive, in approved abattoirs;
6. Standardization of testing procedures through short courses for accredited veterinarians.

Under the new regulations, accredited veterinarians or laboratories apply the Rose Bengal Plate Test as a standard screening procedure. Accreditation is issued by the animal health authorities upon compliance with established requirements, notably the attendance of a one-week official course. Animals that test positive in the screening test may go through a more specific complementary test—2-mercaptoethanol or complement fixation—carried out at an approved laboratory. New diagnostic methods (e.g. fluorescence polarization or competitive Elisa) may be approved as official tests depending on performance and cost. Heifers should be vaccinated between 3 and 8 months of age and are not eligible for serological testing up to the age of 24 months. The production of test antigens is restricted to official state-level laboratories and all batches ought to be approved by the federal reference laboratory. The distribution of antigens is made exclusively by the animal health authorities in order to secure official control over the activity of accredited veterinarians.

The National Program recognizes the utmost importance of compulsory vaccination of heifers under the current epidemiological situation, i.e. widespread disease and medium to high prevalence. B. abortus Strain 19 is the only approved vaccine and is manufactured at several private laboratories. All vaccine batches have to be approved by the federal reference laboratory. Strategic vaccination of adult females with B. abortus strain RB51 might be an option in the near future and depends on the results of a vaccine trial that is underway at the Federal Reference Laboratory.

Vaccination is delivered under the supervision of an accredited veterinarian at full cost to the livestock owner. The cost of the veterinary service increases the overall cost of vaccination. Moreover the economies of scale involved in the provision of veterinary services render vaccination comparably more expensive for small livestock holders who account for most of the dairy production. Brazil is capable of producing vaccine of international standard and in sufficient quantity to supply its massive cattle industry. The socio-economic dimension of the vaccination program poses the most important constraints to achieving higher vaccination coverage and raises the issue of finding new models of interaction between the private sector, the animal health authorities and the livestock community.

The voluntary accreditation of free herds is viewed as process in which the animal health authorities and the private veterinarians set out to improve food safety and aggregate value to the farm produce. The difficulties of implementing a test-and-slaughter policy without the reliance upon generous compensation funds are well known. This led the federal animal health authorities to establish a voluntary scheme in which livestock holders, especially dairy farmers, are encouraged to enter the accreditation scheme. Special programs are sponsored by the dairy industry or by the government aimed at raising the sanitary
standards of livestock produce offered to the market. These kind of programs are ever more frequent in Brazil as a result of increasing purchasing power of urban consumers and of increasing awareness of food safety issues. In 2002, The Ministry of Agriculture set up a special credit program for brucellosis and tuberculosis, through which livestock owners have access to cheap credit for replacing test positive stock slaughtered under the current regulations.

The monitoring scheme for beef herds is an attempt to control brucellosis in large holdings. They often contain thousands of breeding females reared under very extensive grazing conditions. International standards for accreditation of free herds are not applicable to such production systems. The proposed scheme envisages control procedures through periodical testing of a sample of breeding females. The whole breeding herd should be tested whenever a test positive animal is detected. The disease status is protected and assessed through a surveillance system and by imposing strict rules on the introduction of breeding stock into the monitored herd.

In conclusion, the new program for the control of brucellosis in the cattle and buffalo population is bringing about great expectations and interest in the fight against brucellosis in Brazil. Because the program is still in a very early stage of implementation one cannot draw many lessons from the experience. However, the size of the Brazilian livestock sector and the enormous hurdles to be faced are likely to provide important insights into the prospects and strategies for controlling brucellosis in developing countries.

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References


Poester, F.P., 1977. Isolamento de *Brucella abortus* e *suis* respectivamente em bovinos e suínos no RS e SC. In: V Congresso Estadual de Medicina Veterinária.


