












# Survey of bovine brucellosis on the island of Fernando de Noronha, Pernambuco, Brazil\*

## *Investigação sobre brucelose bovina na Ilha de Fernando de Noronha, Pernambuco, Brasil*

Erivânia Camelo de Almeida<sup>1,2,3</sup> ; Marcília Maria Alves de Souza<sup>1</sup> ; Carlos Diógenes Ferreira Lima Filho<sup>4</sup> ; Fernando Jorge Rodrigues Magalhães<sup>4</sup> ; Késia Alcântara Queiroz Pontual<sup>1</sup> ; Filipe Sobral Fonsêca<sup>3</sup> ; Maria Fernanda Vianna Marvulo<sup>5,6</sup> ; Ricardo Augusto Dias<sup>7</sup> ; Fernando Ferreira<sup>7</sup> ; José Soares Ferreira Neto<sup>7</sup> ; Jean Carlos Ramos Silva<sup>3,6</sup> 

<sup>1</sup> Agência de Defesa e Fiscalização Agropecuária do Estado de Pernambuco, Recife – PE, Brazil

<sup>2</sup> Conselho Federal de Medicina Veterinária, Brasília – DF, Brazil

<sup>3</sup> Universidade Federal Rural de Pernambuco, Departamento de Medicina Veterinária, Recife – PE, Brazil

<sup>4</sup> Autarquia Territorial Distrito Estadual de Fernando de Noronha, Fernando de Noronha – PE, Brazil

<sup>5</sup> Grupo UniEduK, Centro Universitário Max Planck, Indaiatuba – SP, Brazil

<sup>6</sup> Instituto Brasileiro para Medicina da Conservação – Triade, Recife – PE, Brazil

<sup>7</sup> Universidade de São Paulo, Faculdade de Medicina Veterinária e Zootecnia, Departamento de Medicina Veterinária Preventiva e Saúde Animal, São Paulo – SP, Brazil

### ABSTRACT

Considering the lack of information about livestock diseases on Brazilian oceanic islands, the occurrence of bovine brucellosis was investigated on the island of Fernando de Noronha, state of Pernambuco, Brazil. Serum samples were collected in October 2009, from all the 105 cows raised on the island at that time. These were examined concurrently using the Rose Bengal test and the Complement Fixation Test. All the samples were negative in both tests, indicating that the cows on the island were likely free from infection by smooth forms of *Brucella*. These results can partly be explained by the prohibition of introduction and importation of both small and large-sized animals that had been implemented through District Decree 19 of February 28, 2004.

**Keywords:** Cattle. Island. *Brucella abortus*.

### RESUMO

Tendo em vista a inexistência de informações sobre a ocorrência da brucelose bovina em ilhas oceânicas brasileiras, investigou-se a presença da infecção na ilha de Fernando de Noronha, Estado de Pernambuco, Brasil. Soros de todas as 105 fêmeas bovinas existentes, colhidos em outubro de 2009, foram examinados concomitantemente pelo teste do Antígeno Acidificado Tamponado e pela Reação de Fixação de Complemento. Todas as amostras foram negativas em ambos os testes, indicando que provavelmente os animais presentes na ilha encontravam-se livres da infecção por *Brucella*. Estes resultados podem ser explicados, em partes, pela proibição da introdução e importação de grandes e pequenos animais, implementada pelo Decreto Distrital 19, de 28 de fevereiro de 2004.

**Palavras-chave:** Bovinos. Ilha. *Brucella abortus*.

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**Correspondence to:**

Jean Carlos Ramos Silva  
 Universidade Federal Rural de Pernambuco, Departamento de  
 Medicina Veterinária  
 Rua Dom Manoel de Medeiros, s/n, Dois Irmãos  
 CEP: 51021-900, Recife – PE, Brazil  
 e-mail: jean.rsilva@ufrpe.br

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Bovine brucellosis is an infectious-contagious anthroponozoonosis caused by a facultative intracellular bacteria belonging to the genus *Brucella*. Classified by the World Health Organization (WHO) as a neglected zoonosis, it is characterized by cells' infection of the mononuclear phagocyte system and, in most cases, it has a chronic evolution. Bovine brucellosis has a worldwide distribution and is presented in the endemic form in many countries, which leads to significant economic losses within animal production chains due to abortions, reduced fertility, and reduced milk production, since this infection mainly impairs the reproductive and osteoarticular systems (Paulin & Ferreira, 2003; Goia et al., 2019).

In Brazil, the epidemiological situation of bovine brucellosis has recently been studied in 18 states (Alves et al., 2009; Azevedo et al., 2009; Chate et al., 2009; Clementino et al., 2016; Dias et al., 2009a, 2009b; Gonçalves et al., 2009a, 2009b; Klein-Gunnewiek et al., 2009; Marvulo et al., 2009; Negreiros et al., 2009; Ogata et al., 2009; Rocha et al., 2009; Sikusawa et al., 2009; Silva et al., 2009; Villar et al., 2009; Borba et al., 2013; Almeida et al., 2016). However, no information regarding the presence of brucellosis on Brazil's oceanic islands is available. These comprise five island groups: the archipelago of Fernando de Noronha; the archipelago of São Pedro and São Paulo; Rocas atoll; the island of Trindade; and the archipelago of Martin Vaz. They are all isolated from the mainland and relatively distant from its coast, and are mostly of volcanic origin, with distinct biodiversity.

The archipelago of Fernando de Noronha is 345 km from the Brazilian coast and comprises a total of 21 islands and

islets. The main islands are Fernando de Noronha, Rata, do Meio and Rasa. The island of Fernando de Noronha has an area of 17 km<sup>2</sup> (comprising above 93% of the archipelago area) and is the only inhabited island. The climate is tropical, with two well-defined seasons: the rainy season (March to July) and the dry season (August to February). The mean annual rainfall is 1,400 mm and the mean temperature is 25 °C (Motta et al., 2008).

Fernando de Noronha was discovered by Amerigo Vespucci in 1503. It was occupied by the Dutch in the 17<sup>th</sup> century and by the French in the 18<sup>th</sup> century before the Portuguese became established there. It became a prison colony twice: in the 18<sup>th</sup> century and 1938 (for political prisoners). During the Second World War, a military base was set up there and the archipelago remained under military administration from 1942 to 1988. In the 1960s, a quarantine area was established by the Ministry of Agriculture, Livestock and Food Supply (MAPA), to receive livestock imported from various countries (Teixeira et al., 2003). In 1988, the archipelago was reintegrated into the state of Pernambuco and today it is an autonomous district within this state. Also, in 1988, a National Marine Park and an Environmental Protection Area were created. The resident population of the archipelago is just over 3,000 people (Instituto Brasileiro de Geografia e Estatística, 2020) and tourism is the main economic activity (Motta et al., 2008).

The biodiversity of the archipelago's wild fauna is varied, but human occupation has given rise to deforestation, mineral exploitation, water body contamination, and the introduction of invasive species, such as synanthropic rodents, dogs, cats, cattle, sheep, and goats (Teixeira et al., 2003). These introduced animals are potential reservoirs for various zoonoses, including brucellosis (Acha & Szyfres, 2001). Although no reports of brucellosis on Fernando de Noronha have ever been produced at the time of writing, this disease had a significantly high prevalence in four states of northeastern Brazil, including Pernambuco, to which the archipelago belongs (Alves et al., 2009; Silva et al., 2009; Borba et al., 2013; Almeida et al., 2016).

Serological studies on bovine and bubaline brucellosis have been conducted on islands in the Caribbean region, including the Bahamas, Barbados, Bermuda, St. Vincent, and the Grenadines, Dominica, Grenada, St. Kitts-Nevis, St. Lucia, Anguilla, Curaçao, Martinique, Guadeloupe, Sint Maarten, Jamaica, British Virgin Islands, Montserrat and Trinidad and Tobago (Organización Panamericana de la Salud, 1994; Fosgate et al., 2011). However, no such studies have been conducted concerning Brazilian oceanic islands. In this regard, the present study aimed to investigate the

epidemiological situation of bovine brucellosis on the island of Fernando de Noronha, Pernambuco, using a serological survey.

In October 2009, blood serum samples were collected from 105 cows that were being kept in semi-intensive rearing systems on 10 small farms. This was the entire population of females that was present on the island at that time. The cattle population of the island also comprised 24 males, but these did not form part of this study (Agência de Defesa e Fiscalização Agropecuária do Estado de Pernambuco, 2009). This sampling campaign was conducted within the second annual stage of vaccination against foot-and-mouth disease, which was coordinated by the Agricultural and Livestock Protection and Inspection Agency of Pernambuco (ADAGRO) and by the Autonomous District Government of Fernando de Noronha, on behalf of the state government of Pernambuco.

The animals were restrained manually in a cattle pen and blood samples of 10 mL were collected into disposable vacutainers through jugular vein puncture. The serum was separated by centrifugation and was stored in polypropylene microtubes that were kept at -20 °C until the serological tests were performed.

The serum samples from the 105 cows were subjected to the buffered acidified antigen test and the complement fixation reaction (Brasil, 2006). The results were interpreted in parallel to improve the test sensitivity (Dohoo et al., 2003). These serological tests were performed at the Federal Laboratory for Agricultural and Livestock Protection in Recife, Pernambuco (LFDA-PE), which belongs to the Ministry of Agriculture, Livestock and Food Supply (MAPA).

All the serological tests using both test procedures were negative. This indicated that the cows on the island were free from infection by smooth forms of *Brucella*. This can partly be explained by the prohibition of introduction and importation of both small and large-sized animals that had been implemented through District Decree no. 019 of February 28, 2004.

Studies on the prevalence of bovine brucellosis conducted in Bahia (Alves et al., 2009) and Sergipe (Silva et al., 2009) identified the introduction of animals as the main risk factor. In another study conducted on 10 farms in the Agreste region of the state of Paraíba, 771 animals were assessed and 15 (1.9%) were found to be positive for brucellosis. The main risk factor for these cases was related to the acquisition of animals (Oliveira et al., 2013).

It is also likely that cattle that had been introduced to Fernando de Noronha may have been free from infection. Previous studies on the maintenance of *B. abortus* showed that this bacterium can survive for around five days at

ambient temperatures. This length of time may increase in situations of milder temperatures and greater humidity and may decrease under the opposite conditions (Aires et al., 2018). The volcanic soil and environment temperature, humidity, and salinity conditions under which the livestock was kept on these subsistence farms on Fernando de Noronha may also have made it difficult for the *B. abortus* to be maintained in that environment.

In the Americas, several other islands are also free from bovine brucellosis: the Bahamas, Barbados, Bermuda, St. Vincent, and the Grenadines, Dominica, Grenada, St. Kitts-Nevis, St. Lucia, Anguilla, Curaçao, Martinique, Guadeloupe, Sint Maarten, and Jamaica. Moreover, no reports of bovine brucellosis were made in the British Virgin Islands, Montserrat, and Trinidad and Tobago (Organización Panamericana de la Salud, 1994). Another study conducted on Galapagos Island showed that all cattle samples were negative for *Brucella* spp. (Goia et al., 2019).

Another important aspect of these negative results for brucellosis from Fernando de Noronha relates to public health, i.e. the importance of this disease as a zoonosis. Among humans, brucellosis is characterized by low mortality and high morbidity. People who are most affected are those who work directly or indirectly in cattle-rearing and slaughtering (Aires et al., 2018).

Even with the long period between the data collection and publication (12 years), it is known by ADAGRO that the sanitary situation of the archipelago remains the same. This happens due to the prohibition of susceptible animals' entrance on the island. This information means that, in the light of the findings from Fernando de Noronha, the need to continue to restrict the entry of cattle to the archipelago may be emphasized. These data also highlight the need for concern regarding workers who have direct or indirect contact with cattle, given that brucellosis is a disease of important zoonotic nature.

### Conflict of Interest

The authors declare no conflicts of interest.

### Ethics Statement

The research was approved by the Ethic Committee on Animal Use of the Rural Federal University of Pernambuco (CEUA/UFRPE) under authorization number 23082.014318/2013-33.

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