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International Cross-border Movements of Horses in the State of Rio Grande do Sul - Brazil: Zoonoses, Biosafety, and Biodefense.

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Abstract

There is a growing integration between countries on the same continent in search of solutions to various issues, including food and technology. In this exchange scenario, countries and their populations are exposed to the spread of zoonoses and pathological agents, including bioterrorism. Rio Grande do Sul (RS) actively participates in the foreign trade of horses, and its modes of transport facilitate territorial capillarity. Equine piroplasmiasis is a zoonosis that causes several economic losses and poses a danger to the human component involved in the process. At the borders of RS, the movement of horses is significant, in the last five years the movements of approximately one thousand horses have been declared, with the Crioulo and Thoroughbred Horses being the most sought after, due to misuse and smuggling an estimated 50% of these numbers for more. For an effective Biological Defense at the borders of the RS, it would be necessary at least one of the Agricultural Security and Defense Units, in the places with the highest traffic, equipped with laboratories, animal quarantine, and specialized personnel. That would have physical control actions and monitoring and gathering information, which can be performed with other species of animals and plants.

Keywords: Trade; Technology; Zoonoses; Bioterrorism; Horses; Piroplasmiasis; Borders; Security; Control; Information

1. Introduction

The state of Rio Grande do Sul (RS) is one of the largest equine export centers in Brazil, with its land borders and privileged logistical location, it establishes modes of transport with the major ports and airports of Mercosur, thus actively participating in the International Trade of Horses (4).

Thus, aspects of Health Surveillance regarding pathological agents, toxins, and zoonoses deserve special attention and efforts to prevent Bioterrorism and Biocrimes. The intentional dissemination of diseases with epidemic potential occurs through the dispersion of pathogenic agents to attack, disable, or kill, for this the effort to curb the use of these resources as weapons are an extremely important variable for Biosafety and Biodefense Planning (9).

Therefore, a view of the state of the art of Equine imports and exports contributes to the prevention of Biological Hazards on the borders of RS, because the economic and health losses of an animal epidemic or Zoonosis are increasingly real in the globalized world.

Equine Piroplasmiasis is one of the main parasitic diseases affecting horses, responsible for great economic losses and restrictions in the international equestrian market, with *Theileria Equi* and *Babesia Caballi* as its main pathological agents (12).

Regarding *Theileria Equi*, many evaluated herds are endemic for the infection, with a high prevalence of asymptomatic carrier animals. With *Babesia Caballi*, it was found that this agent has low circulation in the herds investigated. The

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results reinforce the importance of epidemiological surveillance of vector ticks and their association with infectious agents that pose a risk to the health of the human herd and horses used in the regions evaluated in RS (2). *Theileria Equi* is one of the etiological agents of the disease, characterized by causing a more severe clinical presentation and maintaining asymptomatic carriers in the herd (6).

Its occurrence is directly linked to regions with a subtropical climate, favorable to the development of its vector, the tick; the southern region of Rio Grande do Sul (RS) has a large number of breeding horses of the Crioulo, PSI (Thoroughbred) and BH (Brazilian Equestrian) breeds, as well as sheep and cattle where the horse is widely used.

The State of Rio Grande do Sul has Military Organizations (OM) of the Brazilian Army (BA) and of the Military Brigade (MB) with horsepower, Civil Equestrian Clubs dedicated to Classic Equestrian Sports; in greater number is the Crioulo Horse Breed, with significant circulation both sporting and functional, as they are used in livestock in RS and Brazil, the Crioulo Horse Breed accounts for most of the imports and exports of horses in MERCOSUR (10).

The Brazilian equine industry moved 16.5 billion in 2018, up 15% compared to the previous year, accounting for 3.2 million jobs in the country, a number six times greater than the automobile industry, also according to ESALQ (Superior School of Agriculture Luiz de Queiroz). In addition to the strong economic and cultural influence of equine breeding in Brazil, the horse is also a strong social aggregator, such as riding therapy, which arrived in the country in 1971 and is regulated by the ANDE (National Association of Riding Therapy) founded in 1989 and already trained more than 10 thousand professionals, serving in more than 280 centers spread across the Brazilian territory, much more than leisure and labor, the horse in Brazil today is synonymous with economy and employment (7).

The Southern Common Market (Mercosur) arises from the need to strengthen trade relations between member countries (11), in which RS with borders between Uruguay and Argentina establishes a significant trade, Paraguay, which despite not having a border with RS also establishes an important international trade in horses.

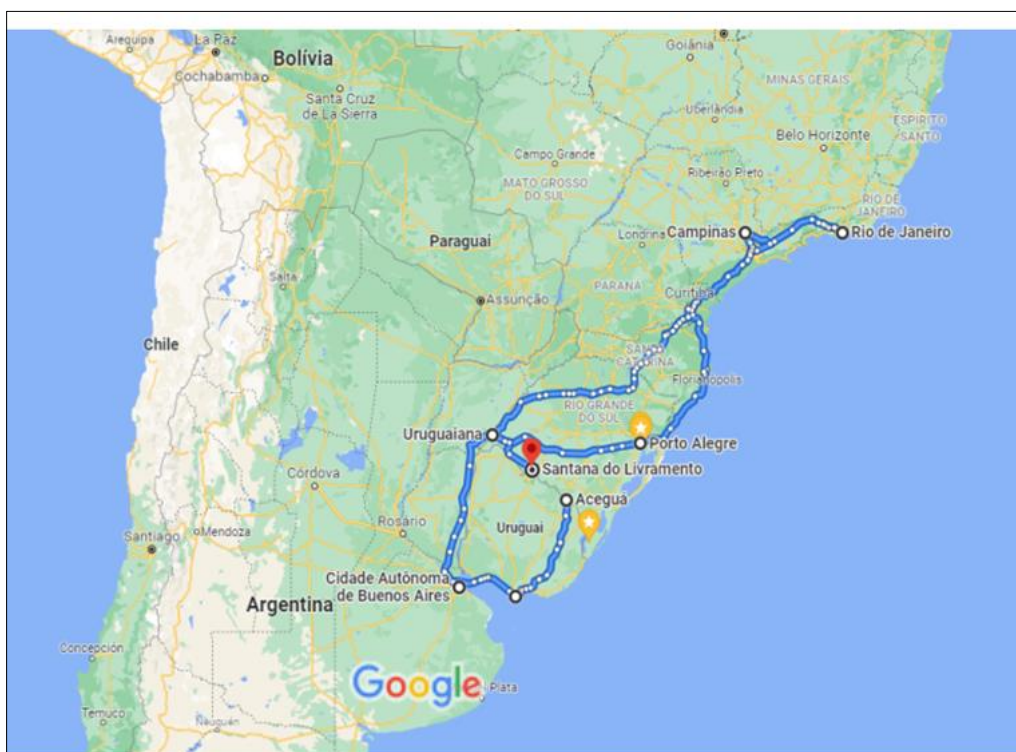


Figure 1 Road Integration, between Brazil’s International Airport of Viracopos, the cities of Montevideo in Uruguay, and Buenos Aires in Argentina. Source: Google Maps

The integration between air and land modes facilitates the connection between the International Airport of Viracopos-SP, the cities of Montevideo in Uruguay, and Buenos Aires in Argentina (Fig-1). In this way, RS establishes logistical arms with international air transport, close to the border with Uruguay is located the city of Bagé, one of the largest breeding sites of the PSI (Thoroughbred) of MERCOSUR, also with a large number of studs of the Crioulo Equine Breed (13).

In the Rio Grande do Sul campaign region, the cities Livramento and Aceguá with land borders collaborate enormously for road transport, all these characteristics of geographic location and variety of breeding, make RS a wide field for international trade and studies with the equine species.

Infectious diseases and animal toxins are considered a threat to both Human and Animal Health, directly affecting the Economy, Biodiversity, Biosafety, and Biodefense (14).

In this context, endemic animal diseases become a threat, as in developing countries they are harmful to agriculture and food security. On the other hand, with the ease of logistics and locomotion, zoonoses spread quickly, bringing serious damage to farms, with serious economic, health, and social consequences.

According to the information available in the WAHIS (World Animal Health Information System), of the OIE (World Organization for Animal Health), only in August 2021 can we mention some events such as Anthrax Bacteria outbreaks, in Spain, with the death of horses and cattle; Influenza A virus outbreaks in Russia, with the death of birds and swans; in September 2021: Newcastle Disease (NCD) Virus Outbreaks in Russia, also known as the pseudo-bird plague, avian pneumoencephalitis, respiratory-nervous disorder, with bird death; African Swine Fever Virus Outbreaks in Haiti, causing harm to the health and nutrition of the population, West Nile Fever Virus Outbreak in Germany, infecting horses and birds; Anthrax Bacteria Focus, in Kazakhstan, contaminating cattle, horses, goats, and sheep; Rabies Virus outbreaks in Germany infecting dogs.

Threats of the occurrence of epidemics of animal origin by infectious agents or toxins are a real risk and should be pointed out in preventive Biodefense and Biosafety strategies involving management with Equines (3).

Due to several characteristics, including low cost, ease of acquisition, and propagation, animal pathogens can be used in biological weapons, crimes, in bioterror, also because of their size they go unnoticed by border barriers, which lack greater inspection and definition of responsible bodies (1).

On the other hand, animals are important Biosensors and Sentinels for the detection of infectious agents and toxins, they can be used in intelligence activities in Public Health and Sanitary Surveillance, for example, the evidence of borrelia circulation with serum prevalence in horses reinforces their role as sentinels, being a warning factor for the potential occurrence of human cases (2).

There are still few available data on the number of horses that transit the RS border, their destination and origin, purpose and health status, even if with a control and inspection system still in need of improvement, this information is of fundamental importance for Biosafety and Biodefense planning, especially as sensors of Zoonoses and Epidemics that are occurring in other countries.

The reduced number of field employees of the Sanitary Surveillance secretariats, the closing of Veterinary Inspectors and Government Quarantine Units in border areas of RS, the growing increase in the number of breeders, and the internationalization of equestrian competitions are factors that contribute to the health risk cross-border. Therefore, it is of fundamental importance to have information that reveals the current reality of equine movements on RS borders, allowing for a minimum starting point for logistics and means planning for the Biosafety and Biodefense areas.

Notwithstanding, the smuggling of animals is present on the borders of RS, and it is estimated that the data obtained in this research are increased by at least 50%.

The scarcity of available data on the subject directly contributes to a distorted view of the sector, and as a consequence, it suppresses the Health and Economic importance of the subject, harming sanitary management in Biosafety and Biodefense.

The protocols used by neighboring countries are often not the same and vary according to government guidelines, the resources for investment in personnel and material do not cover the needs and are subject to political guidelines, which sometimes do not come from specialists in the sector.

The growing number of Zoonoses Epidemics, Bioterrorism, and the increased consumption of animal protein is increasingly worrying factors in the globalized world, so a study on equine transport, Biosafety, and Biodefense in international cross-border movements in RS, from the Biotechnological point of view.

With this study, we intend to present subsidies to draw the attention of authorities to this area, despite emphasizing that Pyroplasmosis, in addition to being a zoonosis, is present in our equine herds in use in the country and that the damages can be avoided with a correct Sanitary policy in international movements (12).

As well as, emphasize risk management in Biosafety and Biodefense, and its current deficiencies, with the Scope of attracting interest and investments in this area, so that with the available information, the appropriate tools can be used promptly, and contribute in this way to technology Culture in the equine sector in RS and Brazil (5).

2. Material and methods

This study has been approved by the Ethics Committee in Animal Experimentation and Animal Welfare at the Federal University of São Carlos - São Carlos, SP. (protocol number CEUA nº 9864100618 (ID 001100)), São Paulo State, Brazil.

Due to the relevance of social, political, ideological, and technical factors involved in the International Equine Trade, we chose a Qualitative Research approach to understand the affected dimensions, and above all, to illuminate shaded areas that potentially contribute to health prevention in this context.

In the search for information from the MAPA (Ministry of Agriculture, Fisheries and Supply) in the State of Rio Grande do Sul, with the collection, classification, and processing of data available in the SEI (Electronic Information System), the import processes were thoroughly revised and export of horses from the last five years.

The space chosen in the research was the State of RS, with its international borders and ease of logistical integration with the International Airports of São Paulo-Brazil, Montevideo-Uruguay, and Buenos Aires-Argentina, in addition to its agricultural vocation and traditional relevance in the equine market of South America.

To this end, the study included Zootechnical data on the Import and Export of Horses in RS, from the last five years, taking into account: Race, Sex, Origin, Destination, and purpose of cross-border movement.

3. Results

From June 2016 to May 2021, 223 horses were imported, mostly for sport and reproduction, with Argentina and Uruguay being the countries with the highest number of animals crossing borders do RS (Fig. 2) Through the air transport modal, via the state of São Paulo, there were imports from the United States, United Kingdom, and Belgium, which were carried out by the Air and Road models.

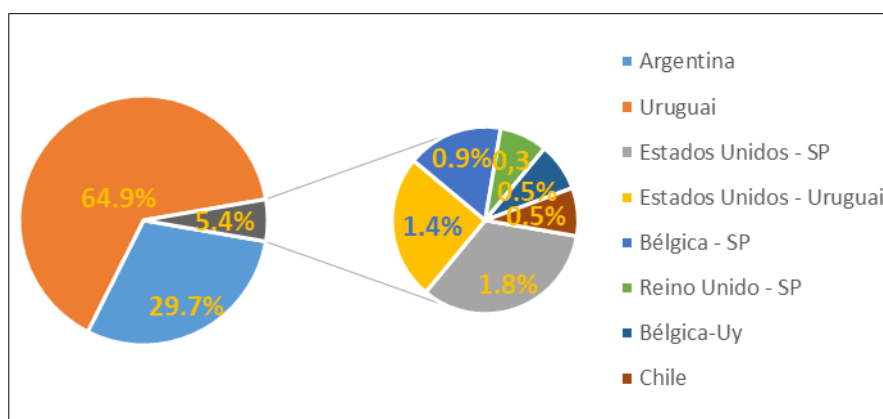


Figure 2 Importation of Equine sport and reproduction, Countries of Mercosur in 2016-2021 in the borders of RS. (Figure created by the author.)

In the same period, the export of horses handled 762 horses, with the most requested destinations being the countries: Uruguay, Paraguay, and Argentina, carried out by the Rodoviário modal. (Fig. 3).

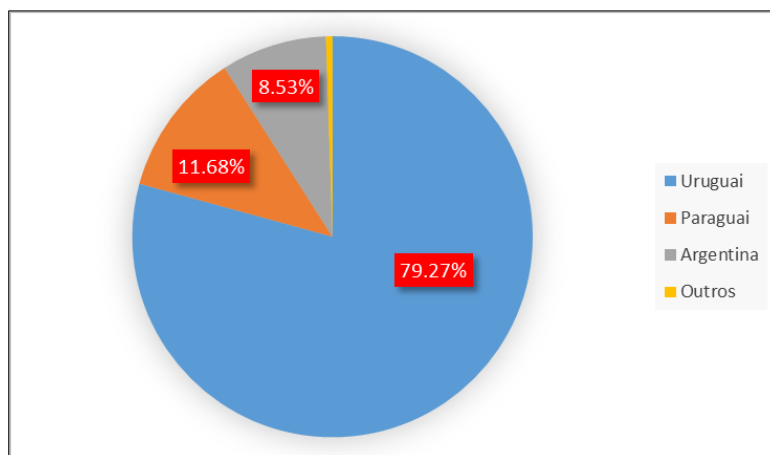


Figure 3 Exportation of Equine of sport and reproduction, with the countries of Mercosur in 2016-2021 in the borders of RS. (Figure created by the author.)

It was observed that the Crioulo and Thoroughbred English Horse breeds are the most rotating on international borders (Table 1), reproduction represented the greatest demand in the period in question, followed by the sport in its various modalities.

Table 1 Impacts of the international movements by several functionalities, R = reproduction, S = sport; in the period of 2016-2021. (Table created by the author.)

Breed	Import	R	S	Export	R	S
Crioulo	124	54	70	347	319	28
English Thoroughbred Horses	50	29	21	347	155	192
Others	48	2	46	68	68	00
Total	222	85	137	762	542	220

4. Discussion

In the last five years, the countries with the greatest international equine traffic were Uruguay and Argentina, and through the air transport mode, via the state of São Paulo, there were imports from the United States, United Kingdom, and Belgium, which were carried out by the Air and Road modes.

According to fieldwork data, an average of 200 horses participate annually in import and export processes, involving transport in trucks and contact with the population that is part of the process.

The purpose of the operation involving horses leads to the geographic destination and its movement within the country, sport offers distances and reproduction, continuity, which facilitates the dispersion of epidemic vectors (8).

The Exporting Country maintains regional relations with other countries, and in this context, it must supply the importer with the following information: Animal health status referring to the status of this deceases listed by the OIE and respective Free Zones; Information on reports of occurrences of notifiable diseases in the country; Service structure Veterinarians and their acting authorities; technical information on biological tests and vaccines applied in all or part of the territory. <https://www.oie.int/en/what-we-do/standards/codes-and-manuals/terrestrial-code-onlineaccess/>.

Veterinary Authorities of exporting countries must: Have accredited veterinarians, defining their functions and attributions, as well as the inspection conditions and including requirements to be fulfilled under penalty of suspension of the authorization; monitor Veterinary certificates and audit their impartiality and integrity.

The number of horses crossing the borders with RS is significantly relevant, their origin and functionality contribute to a significant numerical perspective. Embezzlement and smuggling, which escape regular inspection due to geographic

and management factors, contribute to the possible dissemination of Piroplasmosis and other Zoonoses in the international borders of RS.

5. Conclusion

This work evidenced the position of the State of RS in the context of horse breeding in Mercosur, as a supplying country and place to various activities related to sport. The regional agricultural tradition favors the contact of horses with ticks, which are the vectors of Equine Piroplasmosis, one of the zoonoses that offer greater difficulty for detection and eradication, greatly impairing activities with horses and human and animal health.

Through the data worked in this research, it is possible to conceive of a reality estimated so far about the sector, cross-border movements are one of the main means of dissemination of pathogens, a threat to food and health security, with its area of dispersion still underestimated if we take account of the subsequent destination of horse traffic after crossing the borders.

The reduction of Government Agencies for animal inspection, at the international borders of RS, directly harms the control and assigns responsibilities to interested exporters to comply with sanitary standards, under the supervision of an official veterinarian designated for that purpose.

Although legal, this modality does not contemplate the desired security for preventing epidemics and deliberate biological threats, both because of its structure and intended function.

According to the research data and taking into account the undeclared movements, for an effective response to the needs of Biological Protection and Prevention at the international borders of RS, it is estimated that at least two Agricultural Security and Defense units are needed, in places with higher traffic, equipped with laboratories, animal quarantine, and specialized personnel, who would not only develop physical control actions but also monitoring and information collection, which can also be carried out for other animal species and vegetable.

None of the authors of this paper have a financial or personal relationship, with other people or organizations that could inappropriately influence or bias the content of the paper.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest is to be disclosed.

Statement of ethical approval

The present research work does not contain any studies performed on animals/human subjects by any of the authors.

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