



Vaccination in the Sanitary Management of Cattle: A literature review

Vacinação no Manejo Sanitário de Bovinos: Uma revisão de literatura

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ABSTRACT

The use of vaccines in cattle farming has become routine because it's the main measure of prevention against infectious diseases and for this reason, vaccinating the herd is necessary, as it reduces the rate of circulation of microorganisms that cause pathologies. The objective of this work was to study the application of vaccination to prevent, control and eradicate the transmission of diseases, highlighting the importance of following the vaccination schedule so that certain diseases have their transmission controlled and reduced. The methodology used was theoretical research, descriptive in a literature review. For search purposes, the following databases were consulted: "Periódicos Capes", "SciELO", "Doaj", "Google Scholar", "Beef Report", and Diversitas Journal published in the years 2017, 2020, 2022. Given the diversity of vaccines on the market, this work showed the different types of vaccines for use in cattle breeding, and which diseases can be prevented by the use of vaccines.

RESUMO

A utilização de vacinas na bovinocultura se tornou rotineira por ser a principal medida de prevenção contra doenças infecciosas e por esta razão, vacinar o rebanho se faz necessário, pois reduz a taxa de circulação de microrganismos causadores de patologias. Objetivou-se com a elaboração deste trabalho estudar a aplicação da vacinação para prevenir, controlar e erradicar a transmissão de doenças, destacando a importância de seguir o calendário vacinal para que certas doenças tenham sua transmissão controlada e reduzida. A metodologia utilizada foi a pesquisa de cunho teórico, descritiva em uma revisão de literatura. Para fins de busca foram consultadas as bases de dados: Periódicos Capes, SciELO, Doaj, Google Acadêmico, Beef Report, e Diversitas Journal publicados nos anos a 2017, 2020, 2022. Frente à diversidade de vacinas existentes no mercado, este estudo mostrou os diferentes tipos de vacinas existentes para utilização na criação de bovinos, e quais doenças podem ser prevenidas pelo uso de vacinas.

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Introduction

In Brazil, the cattle herd is considered a highlight both in the domestic and foreign markets. Tangent to this reality is necessary vaccination to keep the herds healthy and free of diseases.

The Federation of Agriculture and Livestock of the Alagoas State (*Federação da Agricultura e Pecuária do Estado de Alagoas - FAEAL*), alerts breeders for vaccination. The vaccination campaign against foot-and-mouth disease continues with the goal of immunizing 1.2 million animals - cattle and buffaloes. In this context, the entity president, Álvaro Almeida, points out that Alagoas has achieved important vaccination coverage in recent years and that he expects a coverage of 100% immunization in 2022, so that in the future the state can reach the zone free of foot-and-mouth disease without vaccination (FAEAL, 2022).

The Agency for Defense and Agricultural Inspection of Alagoas (*Agência de Defesa e Inspeção Agropecuária de Alagoas - ADEAL*) also warns that the breeder who fails to vaccinate and or declare is unable to remove the Animal Transit Guide (GTA) and prevented from circulating or marketing the animals, in addition to being subject to the payment of a fine (FAEAL, 2022).

In order to ensure animal health, the Ministry of Agriculture, Livestock and Supply and state agencies of animal health defense, establish preventive measures regarding vaccination. (BRAZIL, 2009). In this context, it's emphasized that not all diseases are included in health programs and that there is no obligation to control some diseases. So, it's worth mentioning that in the market are available a wide variety of vaccines for cattle, however, the choice of the most appropriate product must be in accordance with the specific legislation for each disease that affects cattle herds.

It should be emphasized that vaccines for use in veterinary medicine are of fundamental importance for animal health and welfare, since they improve the efficiency of food production and act in public health through the prevention, transmission of zoonoses and foodborne diseases (ROTH, 2011).

In order to control and eliminate a disease, it's important to have joint actions of management, environmental sanitation, health education, prophylactic chemotherapy, epidemiological surveillance and diagnostic feasibility. As well as adequate infrastructure and financial resources for the control of diseases to be effective (THRUSFIELD, 2004).

However, some problems occur through incorrect application, among which stand out the loss of doses of the product, the expenses for damage to syringes and needles and the occurrences of work accidents. It's warned that it can occur in animals, injuries at the site of application such as: abscesses, myiasis and or accidents during management and may cause scratches, bruises and even fractures. These accidents may be common, but they cause economic losses.

Other occurrences are cases in which the herd does not become immune, falling ill even after the vaccination stages. This is often due to simple errors in the choice, storage and use of vaccines, as well as in the management adopted to animals during vaccination (FLORES, 2007).

The objective of this study was to study the importance of the application of bovine vaccination in order to prevent, control and eradicate the transmission of diseases. It was verified the different types of vaccines existing for use in cattle breeding, which diseases can be prevented by the use of vaccines and thus present some factors related to the effectiveness of the vaccine and vaccination.

Methodological Procedures

A descriptive literature review study on vaccination in the sanitary management of cattle was conducted. For this study, 03 electronic journals were used; 01 master's thesis; 04 articles and 03 informative sites, which brought themes that contributed to the basis of this work. The organization of the study was through a file of the works studied, where the effectiveness of vaccination was compared.

Through literature review studies the present work aims to bring in arguments that like any medicine, it's expected that vaccines present efficacy in the control and dissemination of diseases, keeping the herds healthy, mitigating economic losses.

Theoretical Reference

The Vaccination Agencies and Laws

The Agency of Defense and Agricultural Inspection of Alagoas (*Agência de Defesa e Inspeção Agropecuária de Alagoas - ADEAL*), in the use of its legal and statutory attributions conferred by Art. 2, of Law No. 6,608, of July 1st, 2005 and Art. 55 of Decree No. 2,919, of November 25th, 2005, Resolves: Art. 1 To regulate the declaration of vaccination against foot-and-mouth disease - according to Art. 26, item IV, of Normative Instruction MAPA No. 48, of July 14th, 2020 - and approve guidelines for the inactivation of the registry of rural establishments and their owners, possessors or holders, as well as of all those who, in any capacity, hold in their possession animals susceptible to inspection by ADEAL, with a view to standardization and security of information in the Computerized System of Agricultural Defense of the State of Alagoas (*Sistema Informatizado de Defesa Agropecuária do Estado de Alagoas*) (ADEAL ORDINANCE, No. 214, April, 13th 2022).

With the goal of vaccinating 1.2 million animals - cattle and buffaloes - against foot-and-mouth disease, ADEAL, an agency linked to the Secretariat of Agriculture, Livestock, Fisheries and Aquaculture of Alagoas (*Secretaria de Agricultura, Pecuária, Pesca e*

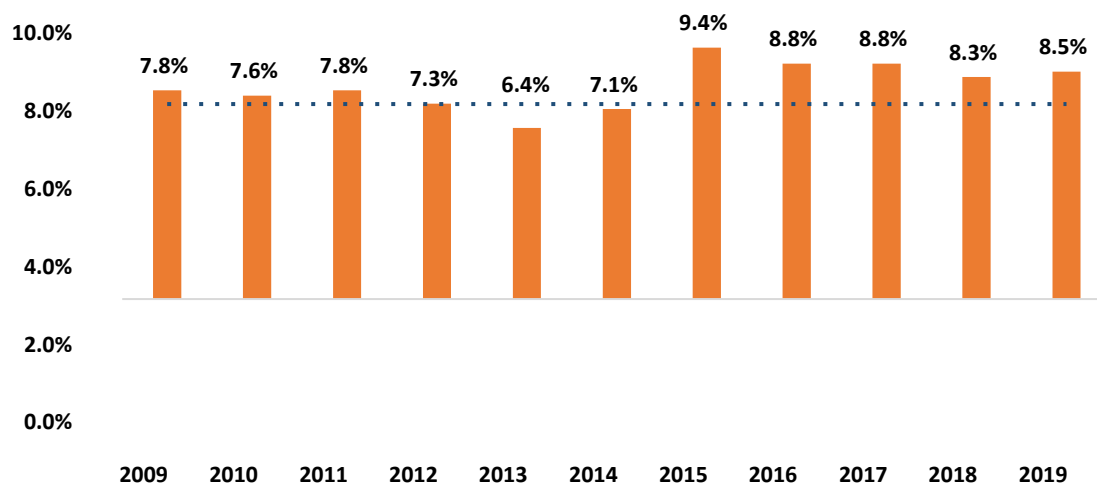
Aquicultura de Alagoas - SEAGRI), held, on April 29th, 2022, the official opening of the first stage of the vaccination campaign.

In 2019, Brazilian cattle ranching reaffirmed its leading position in the world beef market. Given this, the result was the record of the largest volume of beef ever exported by Brazil reaching a total of 1.866 million tons, 13.6% above 2018 (BRAZIL, 2020; CAMARDELLI, 2020).

Thus, the growth of cattle farming in the country has stood out, in 2019 Brazil's GDP was R\$ 7.3 trillion, a nominal growth of 6.8% over the previous year. Part of this growth was due to the GDP of livestock, which in the same period registered a slight growth, going from 8.3% to 8.5% of the total GDP, evidencing the strength of the sector in the Brazilian economy (BRAZIL, 2020).

Figure 1.

Evolution of the GDP Share of Beef Cattle on the Total Brazil GDP.



Source: Athenagro, Abiec, Secex, IBGE, Cepea, BNDS, prepared by Athenagro.

Brazilian livestock has been maintaining and conquering new markets, in which it's necessary to control the animal health situation. Lucena et al. (2010) conducted research studies on bovine diseases with eventual occurrence in southern Brazil, and found intoxications, inflammatory diseases and parasites, which represented 30% of the total, and diseases caused by neoplasms, physical agents, metabolic and nutritional diseases, circulatory disorders, degenerative diseases and growth disorders.

Among the inflammatory diseases revealed in the research of Lucena et al. (2010) were tuberculosis, actinomycosis, rabies, bacterial enteritis, actinobacillosis, abscesses, pneumonias, parasitic diseases (fasciolosis and hydatidosis), symptomatic carbuncle and mastitis.

Through the context, an alert is made about the need for sanitary control measures that include changes in management, with regard to hygienic sanitary measures, care and treatment of sick animals and prophylaxis of diseases. The use of vaccines is one of the

recommended forms of prophylaxis (OLIVEIRA, 2006) given the importance in the control of animal diseases, in food production and in public health (ROTH, 2011).

Cattle and their Immunization

Microorganisms are found in the composition of the vaccines, which stimulates an immune response capable of protecting the individual to whom it was administered when there is subsequent contact with the original agent (FLORES, 2007). Therefore, in order to understand the action of vaccines, it's important to know how the animal's immune response occurs according to contact with pathogens.

Types of Vaccines

It was found that the vaccination of the herd is extremely important, because it prevents and mitigates the rate of circulation of microorganisms that cause pathologies. Vaccines available on the market are prepared to protect cattle against a single agent or pathogen (monovalent) or a set of them (polyvalent).

Some laboratories offer commercial products to prevent against the main causative agents of clinical conditions such as calf diarrhea, clostridiosis, respiratory syndromes, reproductive diseases, among others. The advantage of these products is that all antigens are in balanced proportion for better formation of immune response, in addition to ease of management, with a single application (BRAZIL, 2009).

According to Brasil (2009), states that some cases after the first dose of the vaccine against some diseases, it's necessary to apply the booster, approximately four weeks later or at the discretion of the veterinarian, except for vaccination against brucellosis, in which a single application is indicated for females from three to eight months of age, according to the current national legislation.

Table 1 shows some diseases that affect herds and vaccines that are available in the market, remaining their protective capacity associated with the quality of the product informed by its manufacturer and the conditions in which it was used (BRAZIL, 2009).

Table 1.

Main diseases that affect cattle and can be protected by vaccines available in the market, according to the agent and classification.

Disease	Agent	Classification
Botulism	<i>Cloristridium Botulinium</i>	Bacterium
Brucellosis	<i>Brucella Abortus</i>	Bacterium
Campylobacteriosis	<i>Campylobacter fetus</i>	Bacterium
Hematic carbuncle	<i>Bacillus Anthracis</i>	Bacterium

Symptomatic carbuncle	<i>Cloristridium Chauvoei</i>	Bacterium
Keratoconjunctivitis	<i>Moraxella bovis</i>	Bacterium
Colibacillosis	<i>Escherichia coli</i>	Bacterium
Coronavirus	<i>Bovine coronavirus</i>	Virus
Bovine Viral Diarrhea/Mucosal Diseases (BVD/MD)	<i>Bovine viral diarrhea virus / Mucosal disease</i>	Virus
Enterotoxemia	<i>Clostridium perfringens tipo D</i>	Bacterium
Foot-and-mouth disease	<i>Foot-and-mouth disease virus</i>	Virus
Gas gangrene/malignant oedema	<i>Clostridium septicum, clostridium perfringens, clostridium novyi, clostridium chauvoei e clostridium sordelli</i>	Bacterium
Bacillary hemoglobinuria	<i>Clostridium haemolyticum</i>	Bacterium
Leptospirosis	<i>Leptospira spp.</i>	Bacterium
Pasteurellosis	<i>Pasteurella Haemoytica</i>	Bacterium
Bovine parainfluenza type 3 (PI3)	<i>Bovine parainfluenza type 3</i>	Virus
Anger	<i>Rabies virus</i>	Virus
Infectious bovine rhinotracheitis (IBR)	<i>Infectious bovine rhinotracheitis virus</i>	Virus
Rotavirus	<i>Bovine rotavirus</i>	Virus
Salmonellosis or paratyphus	<i>Salmonella dublin, Salmonella Typhimurium</i>	Bacterium
Tetanus	<i>Clostridium tetani</i>	Bacterium
Respiratory syncytial virus of cattle (BRSV)	<i>Respiratory syncytial virus of cattle</i>	Virus

Source: EMBRAPA (2009). Technical Announcement.

According to the classification, we observed the autogenous or non-autogenous live vaccines (of attenuated, heterologous or virulent microorganisms), inactivated vaccines, vaccines of microbial products (subunits, toxoids or recombinants), vaccines of synthetic peptides and DNA vaccines (QUINN et al., 2005; FLORES, 2007; INNES et al., 2011; CHIARELI et al., 2012).

Autogenous vaccines, called auto vaccines, are manufactured from biological material collected from sick animals, which are intended for the isolation and identification of etiological agents. It's the vaccine obtained from the etiological agent isolated from the animal itself. They are used on properties where specific diseases are occurring. Thus, the use of autogenous vaccines is specific by property (BRAZIL, 2003). Autogenous vaccines are used in cattle breeding for the treatment of chronic infectious diseases or as a preventive therapeutic treatment (NOLTE et al., 2001).

Vaccine Production

Regarding the production of autogenous vaccines, the microorganism that causes the disease is isolated, cultured, inactivated and added to adjuvant agents (NOLTE et al., 2001).

Autogenous vaccines can be monovalent or polyvalent. They are inactivated, immunogenic, non-toxic, innocuous and have neutral pH, between 6.8 and 7.4. When produced from viral strains, the identification of the family of these viruses should be made, while in the isolation of other infectious agents (bacteria and protozoa) the identification is made as to the genus, species and serotype or serum, when appropriate. The function of the most accurate identification occurs because the subspecies or serotypes of the same family have different forms of antigen presentation against the immune response of the host (BRAZIL, 2003).

Attenuated vaccines are produced from microorganisms that undergo attenuation methods that can be: successive inoculations in animal models or cell cultures, genetic manipulation (losing part of their pathogenic power due to the deletion of genes related to pathogenicity) or by temperature (FLORES, 2007; BUDDLE et al., 2011).

The vaccines of attenuated microorganism induce cellular and humoral immunity, do not need adjuvants, because the antigens can reproduce in the body, stimulates good immunological memory, increasing the time between applications of booster doses (QUINN et al., 2005). However, inactivated vaccines are acquired through a dead infectious agent, which has its immunogenicity altered by inactivating agents such as heat or chemicals. There are inactivated vaccines of viruses and bacteria, the latter being prepared from the inactivation of bacterins (cultures of bacteria) or toxoids (toxins produced by bacteria), by chemical treatment with formaldehyde, β -propiolactone or ethylenamine (QUINN, 2005).

When it comes to the characteristic of inactivated vaccines is the activation of humoral immune response, small cellular immune response mediated by cells, which makes more frequent doses of the vaccine (booster doses) necessary for the maintenance of an adequate immune state. Inactivated vaccines are stable at room temperature and can be stored for long periods (QUINN et al., 2005), a fact that benefits farmers who can make longer-term planning for the purchase of vaccines, which will be stored until the time of vaccination of the herd.

Final Considerations

The use of vaccines to maintain the health of cattle herds is essential for the protection of diseases. The vaccine has the potential to reduce the incidence or severity of the disease by stimulating the immune system to provide protection.

Therefore, the cattle breeder should be guided to take the measures of measures related to vaccination at the ideal time and the control of some diseases. It's hoped that this article will lead the reader that vaccination is very important in the sanitary management of cattle, that it's understood as a necessity and not as a government requirement.

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