



## Causes of death of beef cattle raised in feedlots<sup>1</sup>

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**ABSTRACT.**- Estima-Silva P., Oliveira P.A., Bruhn F.R.P., Scheid H.V., Marques L.S., Ribeiro L.S. & Schild A.L. 2020. **Causes of death of beef cattle raised in feedlots.** *Pesquisa Veterinária Brasileira* 40(5):333-339. Laboratório Regional de Diagnóstico, Faculdade de Veterinária, Universidade Federal de Pelotas, Campus Universitário, Pelotas, RS 96010-900, Brazil. E-mail: [alschild@terra.com.br](mailto:alschild@terra.com.br)

The causes of death of cattle kept in pre-export feedlots (PEFs) and in feedlot for finishing for slaughter are described. Two studies were conducted: a retrospective study of mortality cases in feedlots from 2000 to 2017 registered at the “Laboratório Regional de Diagnóstico” of the “Faculdade de Veterinária” of the “Universidade Federal de Pelotas”; and a prospective study from January 2018 to August 2019, following up 22 feedlots for finishing and six PEFs for the export of live cattle. From January 2000 to August 2019 samples of 150 cases of diseases that affected feedlot cattle were received from 22 feedlots for finishing and 115 of the six PEFs followed. Mortality considering all diagnosed diseases was significantly higher in feedlots for finishing ( $p < 0.05$ ), than in PEFs for the export of live cattle, of 1% and 0.12%, respectively. Diseases of the digestive system were the most important causes, of death in feedlots regardless of its purpose. Acidosis presented the highest mortality rates both in feedlot for finishing (3.33%) as in PEFs for export (0.95%). In all cases the disease occurred due to failure in the adaptation of animals to the ingestion of concentrated foods. Bovine tick fever and pneumonia presented mortality rates of 0.13% and 0.09%, respectively in PEFs. In the feedlot for finishing seneciosis was the second cause of death due to cattle coming from areas with high infestation by the plant. In the present study, it was possible to identify the main diseases that occur in cattle feedlots for finishing or for the export of live animals in the southern region of Rio Grande do Sul. These diseases are known in other systems of cattle breeding and can be prevented or controlled through management, chemoprophylaxis or vaccination, minimizing losses due to mortality.

INDEX TERMS: Beef cattle, feedlot, pre-export feedlots, acidosis, bloat, respiratory diseases, tick fever, cattle.

**RESUMO.**- [Causas de morte de bovinos de corte criados em confinamentos.] Descrevem-se as causas de morte de bovinos mantidos confinados em estabelecimentos pré-embarque (EPEs) para exportação de animais vivos e em

estabelecimentos de terminação para abate. Foram realizados dois estudos: um retrospectivo dos casos de mortalidade em confinamentos de 2000 a 2017 registrados no Laboratório Regional de Diagnóstico da Faculdade de Veterinária da Universidade Federal de Pelotas; e um estudo prospectivo de janeiro de 2018 a agosto de 2019, acompanhando-se 22 confinamentos de terminação e seis EPEs para exportação de bovinos vivos. No total, de janeiro de 2000 a agosto de 2019 foram recebidos no LRD-UFPEL amostras de 150 casos de enfermidades que afetaram bovinos confinados, 35 provenientes de 22 confinamentos de terminação e 115 dos seis EPEs acompanhados. A mortalidade considerando-se todas as enfermidades diagnosticadas foi significativamente maior nos confinamentos para terminação ( $p < 0,05$ ), do que nos EPEs para exportação de bovinos vivos, de 1% e 0,12%, respectivamente. As doenças do sistema digestivo foram

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as causas de morte mais importante nos confinamentos, independente da finalidade. Acidose apresentou as maiores taxas de mortalidade tanto nos confinamentos para terminação (3,33%) como nos EPEs para exportação (0,95%). Em todos os casos a doença ocorreu devido a falha na adaptação dos animais à ingestão de alimentos concentrados. Tristeza parasitária bovina e pneumonias apresentaram taxas de mortalidade de 0,13% e 0,09, respectivamente em EPEs de exportação. Nos confinamentos para terminação a seneciose foi a segunda causa de morte devido aos bovinos serem provenientes de áreas com alta infestação pela planta. Este estudo permitiu identificar as principais enfermidades diagnosticadas em confinamentos para terminação de bovinos ou para exportação de bovinos vivos na região Sul do Rio Grande do Sul. Observou-se que são doenças que ocorrem em outros sistemas de criação de bovinos e que podem ser prevenidas ou controladas por meio de manejo, quimioprofilaxia ou vacinação, minimizando prejuízos por mortalidade de animais.

**TERMOS DE INDEXAÇÃO:** Bovinos de corte, confinamento, estabelecimento pré-embarque, acidose, timpanismo, doenças respiratórias, tristeza parasitária.

## INTRODUCTION

In recent years, there has been an increase in the demand for the diagnosis of diseases in cattle in the area of influence of the “Laboratório Regional de Diagnóstico”, of the “Faculdade de Veterinária”, of the “Universidade Federal de Pelotas” (LRD/UFPel), especially in feedlot cattle. The main purpose of feedlots in Brazil is cattle finishing, i.e., to produce animals ready for slaughter (Malafaia et al. 2016). In 2014, 2.4% of the Brazilian cattle herd (198.7 million heads) was finished in feedlots, representing 10.8% of the 43.3 million heads officially slaughtered across the country. This livestock rearing system has expanded due to the appreciation of the dollar and consequently, the increased export of live cattle (Bailone 2019). These animals are maintained in pre-export feedlots (PEFs) for periods predetermined by the importing countries. Despite this increase in feedlot cattle, little is known about the diseases affect cattle that occur in this rearing system in southern Brazil, as well as their impacts on animal health, production and costs (Malafaia et al. 2016).

Respiratory diseases are the main causes of morbidity and mortality in cattle feedlots in the United States, despite advances in operational management and health protocols in this sector. The cumulative incidence of these diseases is estimated at 16.2% (Avra et al. 2017), impacting the profitability of farms that use this system for cattle finishing (Cernicchiaro et al. 2013). It has been mentioned that approximately 75% of morbidity and 50% of mortality in cattle feedlots in the United States is caused by respiratory diseases (Kelly & Jansen 1986, Edwards 2010). In Brazil, in addition to pneumonia, digestive disorders are also cited as important diseases diagnosed in feedlot cattle (Malafaia et al. 2016). In the area of influence of LRD-UFPel, which corresponds to the southern region of Rio Grande do Sul, surveys and previous retrospective studies have shown that diseases of the respiratory tract are important causes of death in calves, mainly of dairy breeds, up to one year of age raised in feedlots (Assis-Brasil et al. 2013). However, little is known about the causes of death in cattle reared in feedlots for finishing or exportation. It is,

therefore, fundamental to know the main causes of death in this breeding system to identify control strategies, which could prevent economic damage to beef cattle ranching in the region.

The goal of this paper was to determine the main diseases that cause mortality in feedlot cattle in the area of influence of the LRD-UFPel, verify their prevalence and develop control strategies according to the current reality of this breeding system.

## MATERIALS AND METHODS

A retrospective study of diagnosed diseases in feedlot cattle in the area of influence of the LRD-UFPel was carried out, and the mortality rates and epidemiological characteristics of each disease were verified. For this study, a survey of necropsy reports from the LRD-UFPel from January 2000 to December 2017 was conducted.

A prospective study was also carried out on feedlot cattle farms in the southern region of Rio Grande do Sul state. The feedlots were visited to identify the sanitary condition, food management practices and the age of the cattle on each farm since protocols differ and depend on the ultimate goal of each farm. This study was conducted in feedlot cattle intended for export to Turkey and Venezuela as well as feedlots dedicated to slaughtering.

Necropsies were performed at the feedlots or at the laboratory to diagnose the diseases that caused the death of the cattle. The organs of the cattle subjected to necropsy by the veterinarians responsible for the feedlots were also sent to the LRD-UFPel. Complementary analyses (histopathological, bacteriological, parasitological) were performed when necessary to confirm the diagnosis. Outbreaks were considered when several animals with similar clinical signs reported by the responsible veterinarians died within a short period of time. As many necropsies as possible were performed for each outbreak.

**Export to Turkey.** The cattle destined for export to Turkey remained in quarantine after the number of animals to be exported was reached (minimum 8000 heads). After the entry of all cattle in PEF, which could take up to 15-20 days due to the significant number of cattle, quarantine conditions were initiated by “Ministério da Agricultura Pecuária e Abastecimento” (MAPA). During this period (21 days), the entry or exit of animals was prohibited (MAPA 2018). The total duration of stay in the PEFs could reach 45 days.

Cattle were submitted to an incoming sanitary protocol involving endectocidal drugs, vaccines against infectious bovine rinotracheitis (IBR), bovine viral diarrhoea (BVD), bovine respiratory syncytial virus (BRSV), bovine parainfluenza (PI), *Pasteurella multocida* and *Mannheimia haemolytica*, and clostridiosis, in addition to a dose of oxytetracycline. In these operations, chemoprophylaxis for bovine tick fever was performed with imidocarb (1,2mg/kg of body weight) or oxytetracycline (6,7mg/kg of body weight) and diminazene diacetate (1.17mg/kg of body weight). Animals intended for export were noncastrated males aged up to 18-month-old, of European breed standard, and with a maximum body weight of 285kg. During the quarantine period, blood was collected from all the cattle; the blood samples were required to be negative for IBR, BVD, paratuberculosis and leukosis. Animals positive for any of these diseases were isolated and considered unfit for export but released into domestic trade after the embarkation of the others. In the same period, the animals were also tested for tuberculosis and brucellosis. If they were positive for either of these diseases, they were isolated and referred for sanitary slaughter after the end of quarantine and the boarding of the other animals.

**Export to Venezuela.** For those intended for export to Venezuela, the quarantine period, also supervised by MAPA, was 24 hours; however, cattle could remain on site for approximately 15 days to complete the lot to be exported. Cattle in this case had to be males, and there were no requirements for age or breed pattern or sanitary protocols because slaughtering was performed shortly after arrival at the destination. Body weights above 400kg were required. In these operations, chemoprophylaxis for bovine tick fever was performed only in cattle from Santa Vitória do Palmar/RS due to the absence of the tick (*Rhipicephalus microplus*), which is the only vector of babesiosis and the main vector of anaplasmosis, in that region.

**Finishing feedlots.** In the finishing feedlots, only cattle aged over 12 months were included. These animals were reared in pastures before arriving at the feedlots. Vaccinations were not required, although owner generally administered preventive vaccinations for clostridiosis and performed endectocidal treatments and preventive chemoprophylaxis for bovine tick fever. The animals remained in the feedlot for approximately 90-120 days.

**Statistical analysis.** The program OpenEpi was used for all the statistical analyses (Dean et al. 2006), and a minimum confidence of 95% was considered ( $p < 0.05$ ). Comparisons of the specific mortality rates (%) of the different diseases observed within and

between each feedlot system were made using Fisher's exact tests or chi-square tests. Fisher's exact test was performed when there were less than five observations in the contingency table for the test. The mortality rate was calculated considering the number of dead cattle as a result of each disease during each feedlot cycle. The quantification of the risk of occurrence of diseases was performed by calculating the relative risk with a confidence interval of 95%.

## RESULTS

From January 2000 to August 2019, 150 materials were received at the LRD-UFPel for the diagnosis of diseases that affected feedlot cattle, including cadavers for necropsies and refrigerated or formalized organs. Six PEFs located in the municipalities of Capão do Leão, Rio Grande, Turuçu, Cristal and Eldorado do Sul that exported cattle lots to Turkey and/or Venezuela were followed. Out of the 150 materials received, 35 came from 22 feedlots for finishing cattle, and 115 came from the six PEFs.

Diseases diagnosed in PEFs for cattle intended for export to Turkey and in feedlots for finishing are presented in Table 1 and 2, respectively. In a population of 8,000 at-risk

**Table 1. Diseases diagnosed in beef feedlot cattle for export to Turkey, population at risk and specific mortality rate in the southern region of Rio Grande do Sul, from January 2000 to August 2019**

Diagnosis	No. of dead	Population at risk	Mortality rate (%)*
Acidosis	95	10000	0.95a
Bloat	70	36000	0.19b
Tick fever	30	24000	0.13c
Pneumonia/bronchopneumonia	27	30000	0.09c
Starvation	4	16000	0.03d
Trauma	3	16000	0.02d
Abomasum ulcer	3	16000	0.02d
<i>Senecio</i> spp. poisoning	2	16000	0.01d
Pericarditis	2	16000	0.01d
Peritonitis	2	16000	0.01d
Ceratoconjunctivitis	1	8000	0.01d
Coenurosis	1	8000	0.01d
Meningitis	1	8000	0.01d

\* Different letters in column indicate statistical difference ( $p < 0.05$ ) by chi-square test.

**Table 2. Diseases diagnosed in beef feedlot cattle to finishing, population at risk and specific mortality rate in the southern region of Rio Grande do Sul, from January 2000 to August 2019**

Diagnosis	No. of dead	Population at risk	Mortality rate (%)*
Acidosis	10	300	3.33a
<i>Senecio</i> spp. poisoning	28	1170	2.39ab
Pneumonia/bronchopneumonia	13	870	1.49bc
Bloat	22	1600	1.38c
Tick fever	23	2000	1.15c
Abomasum ulcer	1	348	0.29cd
Tetanus	5	2500	0.20d
Rabie	1	1200	0.08d

\* Different letters in the column indicate statistical difference ( $p < 0.05$ ) by the chi-square test.

animals in a PEF for export to Venezuela, five animals died of bovine tick fever, and three died of trauma. The mortality rates in this case were 0.063% and 0.038%, respectively. The comparison of mortality rates of all the diseases diagnosed in PEFs intended for Turkey and in feedlots for finishing is presented in Table 3. The mortality rate was significantly higher ( $p < 0.05$ ) in feedlots for finishing than in feedlots for export.

Deaths by acidosis occurred in both PEF and finishing feedlot. This disease presented the highest mortality rates both in feedlots for finishing (3.33%) and in PEFs for export to Turkey (0.95%). Acidosis occurred in two PEFs and in a feedlot for finishing. In one PEF, cattle were fed concentrate in a quantity equivalent to 3% of their body weight to increase bulk. In the other, the cattle received a commercial mixture of oatmeal with concentrate. In the finishing feedlot, cattle received corn silage and concentrate, and there was no prior adaptation of the animals to the food. In these cases, anorexia, dehydration, ruminal atony and recumbency were observed. The necropsies showed that the ruminal content was liquified, yellow-green in color and acidic. Histologically, the rumen showed increased papillae and the vacuolization of epithelial cells, forming vesicles. There was also multifocal neutrophil infiltrate in the mucosa and rumen submucosa, forming small pustules.

Bloat caused the death of 92 animals in two PEFs and in a feedlot for finishing (Table 1 and 2). In a PEF, the diet contained concentrate (30%) and corn silage (70%), and a consumption rate of 0.5% of the body weight of the animals was calculated. There was gradual adaptation of the cattle to the food until a proportion of 50% concentrate with consumption of 2% to 2.2% of their body weight was achieved. The outbreak in this case occurred in cattle that arrived at the feedlot after the beginning of adaptation and, therefore, did not participate in the adaptation process. In another PEF, cattle were maintained for a period without a diet of concentrate plus oats. The

manufacturer indicated that diet should be provided daily *ad libitum* in covered troughs. The feed was removed after consumption and administered again at variable intervals up to 10 hours later due to the absence of coverage in the troughs. In a single feedlot for finishing, the protocol indicated by the manufacturer was followed. This protocol consisted of feeding the animals the diet in the trough alternated with feeding in the pasture, which was gradually decreased until only concentrated feed was administered on the basis of 2% of their body weight. In one outbreak, there was no history of adaptation of cattle to food or the composition of the diet.

In cases of bloat, clinical signs were characterized by marked rumen distension, respiratory difficulty, salivation and protrusion of the tongue. During the necropsies, ruminal dilation, tongue and rectum protrusion and the presence of foam mixed with ruminal content were observed. In the cadavers, congestion of the musculature and organs in the thoracic cavity and pallor of the tissues in the caudal portion was also observed. This difference was eventually observed in a marked line in the caudal third of the esophagus, called the bloat line.

Bovine tick fever was diagnosed on 58 occasions in four PEFs and in four feedlots for finishing, and the disease manifested in both isolated cases and outbreaks. Table 4 shows cases of bovine tick fever according to the etiological agent. Five outbreaks of bovine tick fever diagnosed in feedlots for finishing occurred, with mortality reaching 2.5% in feedlots that did not administer chemoprophylaxis for the disease. In a PEF in which two export operations to Venezuela took place, cattle from Santa Vitória do Palmar did not get sick. In PEFs in which all animals were submitted to chemoprophylaxis for bovine tick fever, the mortality rate was 0.1%.

Anaplasmosis was clinically characterized by jaundice or anemia and fever. In cases of cerebral babesiosis, incoordination and eventual aggression were observed. The necropsies revealed

**Table 3. Mortality rate comparison and quantification of disease risk between cattle finishing feedlot and pre-export feedlots (PEF)**

Diagnosis	Finishing*	PEF Turkey*	RR**	CI***
Acidosis	3.33a	0.95b	3.51	1.85 - 6.66
<i>Senecio</i> spp. poisoning	2.39a	0.01b	191.5	45.67 - 802.60
Pneumonia/bronchopneumonia	1.49a	0.09b	11.95	6.26 - 22.84
Bloat	1.38a	0.19b	7.07	4.39 - 11.39
Tick fever	1.15a	0.13b	9.20	5.36 - 15.81
Abomasum ulcer	0.29a	0.02b	15.33	1.60 - 146.90
All diseases	1.00a	0.12b	8.69	7.01 - 10.770

\*Different letters in the line indicate statistical difference ( $p < 0.05$ ) by the chi-square test, \*\* RR = relative risk, \*\*\* CI = 95% confidence interval.

**Table 4. Number of cases of tick fever according to etiological agent in beef cattle feedlot in the southern region of Rio Grande do Sul, from January 2000 to August 2019**

Etiological agent	No. of dead	Population at risk	Mortality rate*
<i>Anaplasma marginale</i>	20	34000	0.06a
<i>Babesia bovis</i>	13	34000	0.04ab
Mixed infection	6	34000	0.02b
<i>Babesia bigemina</i>	5	34000	0.02b

\* Different letters on the column indicate statistical difference ( $p < 0.05$ ) by the chi-square test.

that the liver was yellowish and enlarged, and the biliary vesicle was distended with lumpy contents. Splenomegaly with protrusion of red pulp was observed, and the kidneys appeared dark. In cases of cerebral babesiosis, the cerebral cortex presented cherry-red coloration. In two cases of cerebral babesiosis, no clinical signs were observed. The diagnosis confirmation was made by observation of Giemsa-stained organ smears in which f parasitic structures within the red blood cells compatible with *Anaplasma marginale*, *Babesia bigemina* and/or *Babesia bovis* were identified.

Pneumonias occurred in three PEFs and in two feedlots for finishing, affecting a total of 40 cattle, all under 18 months of age. In PEFs for export to Turkey, a vaccination against the respiratory diseases IBR, BVD, bovine respiratory syncytial virus, bovine parainfluenza, *Pasteurella multocida* and *Mannheimia haemolytica* from different manufacturers was administered at the time of entry of the animals into the feedlot.

Cattle diagnosed with respiratory diseases presented dyspnea, sialorrhoea and, eventually, uni- or bilateral purulent nasal discharge. Gross lesions ranged from mild anteroventral consolidation accompanied by edema and pulmonary emphysema to irregular areas of atelectasis with pulmonary hepatization and fibrin deposition, according to the gravity of the case. Histologically, edema, congestion and hemorrhage, inflammatory infiltrate of mononuclear cells, necrosis of alveolar walls and syncytial cells that sometimes presented necrosis were observed. There were also mixed inflammatory infiltrates in the bronchi, bronchioli and alveoli as well as hyperplasia due to type II pneumocytes and marked edema in the interlobular septa and alveoli in addition to oat grain cells. There was growth of *M. haemolytica* in bacterial culture performed from lung samples collected at necropsy in two cases and *P. multocida* in three cases.

Cases of bovine tick fever, pneumonia and bloat also occurred without obvious clinical signs.

Thirty cases of *Senecio* spp. poisoning were diagnosed, two of which occurred in animals less than 18 months old who were confined to two PEFs. The other 28 cases occurred in five different feedlots for finishing, and the animals were over 18 months of age. The clinical signs included progressive weight loss and diarrhea. The liver was firm, whitish, with nodules on the surface. There was also edema of the vesicle wall, ascites and edema in the mucosa of the abomasum. Histologically, fibrosis, megalocytosis and proliferation of the bile ducts was observed.

The other diseases occurred sporadically, with low mortality (Table 1 and 2).

## DISCUSSION

The results of the present study showed that cattle mortality was significantly higher in feedlots for finishing than in PEFs for the export of live cattle. Cattle destined for export receive greater care in feedlots due to the requirements of the importing countries; this care does not occur in animals in feedlots for finishing. Other factors, such as cattle age and time of stay in the feedlot, could also influence the mortality of animals on these farms.

In the present study, the diagnosis of diseases that caused mortality in feedlots in the southern region of Rio Grande do Sul was performed with relative ease. Although many clinical signs of diagnosed diseases are nonspecific, diagnosis was

possible by examining macroscopic and histological lesions to confirm the clinical suspicion of each disease. Death without obvious clinical signs in cases of ruminal bloat, pneumonia and cerebral babesiosis in confined cattle described in this study has also been reported by other authors (Glock & DeGroot 1998). Cerebral babesiosis is described as one of the leading causes of death without obvious clinical signs in cattle in the region (Estima-Silva et al. 2016).

Diseases of the digestive system, mainly acidosis, caused the highest mortality in feedlot cattle in the southern region of Rio Grande do Sul from 2000 to 2019. This is not surprising since when cattle reach the feedlot, regardless of the system, they start ingesting carbohydrate-rich rations, often without prior adaptation or with insufficient adaptation. In the present study, it was observed that all cases of acidosis occurred in export and termination feedlots, in which cattle were not adapted to the new feed or the adaptation was inadequate or late. Cattle fed excessive amounts of highly fermentable carbohydrates associated with inadequate amounts of fiber can lead to ruminal acidosis (Valente et al. 2017). A gradual adaptation to this type of food can be effective in preventing the condition (Snyder & Credille 2017).

Additionally, with regard to diseases affecting the digestive system, bloat is as an important disease in feedlots, regardless of their purpose for finishing or export. This disease occurs in cattle fed diets rich in grains and is related to factors such as the physical form of the diet and changes in the populations of ruminal bacteria and protozoa and their fermentation products (Meyer & Bryant 2017). In an outbreak described in this paper, the lack of adaptation to food was identified as a cause of the outbreak. In another outbreak, the cattle were fasted for up to 10 hours, which predisposes them to the occurrence of bloat due to the eagerness with which animals begin to feed when they have access to food again. This has been described by other authors who noted that hunger led to the ingestion of excessive amounts of food after a period of fasting (Abdisa 2018). The individual case observed in a feedlot for finishing demonstrated that previous adaptation is effective in avoiding the disease, since in this feedlot, the animals were adapted, and only one case occurred, probably due to individual susceptibility of the animal.

Another disease of importance in the feedlots in the region during the study period was bovine tick fever. There was no significant difference between the occurrence of anaplasmosis and babesiosis in both types of feedlots. In an epidemiological study on bovine tick fever in the southern region of the state, approximately 60% of the diagnosed cases were babesiosis (Almeida et al. 2006). In feedlots in general, there is no favorable environment for the tick to complete its cycle; therefore, in the case of babesiosis, which is transmitted exclusively by this ectoparasite, cattle probably entered in feedlot during the incubation period of the disease. On the other hand, babesiosis can occur due to imbalance between the inoculum and the immune state of the animal that may decrease due to stress. This fact would explain the occurrence of the disease throughout the feedlot stay (Gonçalves 2000). Another important fact is that most animals reared in feedlots for finishing or export are less than 24 months old and are therefore included in the age group most susceptible to bovine tick fever in the southern region of the Rio Grande do Sul (Almeida et al. 2006). In addition, European breed of

cattle, which are most susceptible to bovine tick fever, are in demand for export feedlots and are predominant in feedlots for finishing in certain regions.

Cattle tick fever prophylaxis was efficient in preventing the occurrence of the disease in feedlots in this study. It has been shown that animals receiving chemoprophylaxis are nine times less likely to die as a result of this disease than those who don't receive chemoprophylaxis. In addition, it should be noted that PEF cattle from Santa Vitória do Palmar that were treated did not get sick. This region of RS, which is located south of parallel 32, is free from the vector ticks and therefore cattle are more susceptible to bovine tick fever (Almeida et al. 2006). This suggests that the use of anaplasma and babesia drugs can be used to control these diseases in feedlot cattle. It has been shown that in addition to preventing the disease, these drugs also increase weight gain (Silva et al. 2015).

Pneumonia was also a significant cause of death among feedlot cattle, especially in those in finishing feedlots. Respiratory disorders have been identified as the leading causes of death in cattle in Brazil (Malafaia et al. 2016) and in other countries (Avra et al. 2017). All cases of pneumonia occurred in cattle under 18 months of age. The age of cattle is a risk factor for the occurrence of pneumonia (Avra et al. 2017). The disease was the leading cause of death in calves under one year in a retrospective study of mortality in young animals conducted in the area of influence of the LRD-UFPel (Assis-Brasil et al. 2013). The results of this study showed that unvaccinated finishing feedlot cattle were approximately 12 times more likely to die than vaccinated cattle. In PEFs for export to Turkey, cattle were vaccinated against respiratory diseases, and mortality was significantly lower than mortality due to these diseases in finishing cattle. This indicates that the practice is effective in preventing deaths from this disease. Other studies have reported that the vaccine is effective, especially if administered before the animals enter the feedlot (Magalhães 2017). Another fact that should be mentioned is that even with epidemiological conditions favorable for the occurrence of disease in PEFs, such as age and stress, mortality due to this disease was lower in these feedlots, which also reinforces the idea that vaccination is effective in the control of this disease.

*Senecio* spp. poisoning was the second cause of death in feedlots for finishing. Intoxication by this species is one of the most important causes of death in cattle reared in the field in the southern region of Rio Grande do Sul and mainly affects animals older than 18 months (Grecco et al. 2010, Panziera et al. 2018). In the feedlots for finishing, cattle were older than 18 months and came from this region; thus, cases of intoxication were expected. It should be noted that this is not a disease that occurs as a result of the feedlot itself or its management. The acquisition of cattle for feedlots from areas where there is no *Senecio* spp. or where the plant is controlled is the only way to prevent deaths from intoxication during the feedlot period. In PEFs exporting to Turkey, the chances of intoxication are substantially decreased. This is probably because the cattle in these feedlots are usually newly weaned calves that go straight to the feedlot without sufficient contact with the plant.

Other diseases that caused deaths in feedlot cattle include abomasum ulcer, which has been previously reported as

a disease that generates economic losses in feedlots. This disease has a multifactorial etiology, including stress and changes in feeding characteristics (Marshall 2009), factors observed in the studied feedlots. However, in the feedlots in this study, mortality from this disease was low. Starvation and trauma also had little importance as a cause of death. In general, starvation occurs due to a lack of adaptation to the feed due to temperament, which prevents it from feeding from the trough (Macitelli et al 2018). Trauma occurs due to sodomy and is very frequent when intact male cattle are kept in agglomerations (Macitelli et al 2018), which was observed in this study. Rabies was diagnosed in a bovine in a feedlot for finishing; it was likely that the affected bovine was already in the incubation period of the disease when it reached the feedlot. Attention should be drawn to the possibility of outbreaks when the disease is diagnosed in places near confinement areas where there is crowding of animals, which is a risk factor for the spread of the disease. Other diseases, such as pericarditis, peritonitis, meningitis, listeriosis, tetanus and coenurosis, occurred sporadically and did not greatly affect the mortality rate.

In the present study, it was possible to demonstrate the main diseases that occur in cattle feedlots for finishing or for the export of live animals in the southern region of Rio Grande do Sul. These diseases are known in other systems of cattle breeding and can be prevented or controlled through management, chemoprophylaxis or vaccination, minimizing losses due to mortality.

## CONCLUSIONS

Cattle mortality is significantly higher in feedlots for finishing than for export in the southern region of Rio Grande do Sul.

Ruminal acidosis, bloat, pneumonia and bovine tick fever were the main causes of death in cattle feedlot both for export and finishing in the southern region of Rio Grande do Sul.

The gradual introduction of high fermentable carbohydrate-rich diet to feedlot cattle, in general, is efficient to prevent deaths from acidosis and bloat.

Cattle over 18 months old, when originating from areas with *Senecio* spp. can enter feedlots already intoxicated by the plant.

Chemoprophylaxis for bovine tick fever proved to be efficient for the control of outbreaks of the disease in feedlots.

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