

1 The Biologist (Lima), 2026, vol. 24 (2), XX-XX.

2 DOI: <https://doi.org/10.62430/rtb20262422181>

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ORIGINAL ARTICLE / ARTÍCULO ORIGINAL

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MAIN CAUSES OF CONDEMNATION OF CATTLE CARCASS AND VISCERA IN A

10 REFRIGERATED SLAUGHTERHOUSE IN THE TOCANTINA REGION OF MARANHÃO,

11 BRAZIL

12

13 PRINCIPALES CAUSAS DE CONDENACIÓN DE CANALES Y VÍSCERAS BOVINAS EN

14 UN MATADERO FRIGORÍFICO DE LA REGIÓN TOCANTINA DE MARANHÃO, BRAZIL

15

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23 Running Heads: Condemnation of Cattle Carcass and Viscera in Maranhão, Brazil

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31 ABSTRACT

32 The objective of this study was to report the main causes of viscera and carcass condemnation in
33 cattle slaughtered in a municipal slaughterhouse under state inspection (SIE), in the state of
34 Maranhão, Brazil. In this way, for the realization of this study, all conviction data in the years 2021
35 and 2022 were tabulated, using daily records of condemnation of carcasses and viscera from the

36 Frigorific slaughterhouse. During the period evaluated, the slaughter of 3,432 cattle, with 2,245
37 animals slaughtered in 2021 and 1,185 animals slaughtered in 2022, of which n=413 (100%)
38 convictions were recorded, of which n=410 (99.3%) were condemnation of viscera and n=3 (0.7%)
39 of total condemnation of bovine carcasses. In viscera convictions, the most affected organ was the
40 kidney, with 161 cases, corresponding to 37.5%. followed by lung n=116 (27.1%), liver n=93 (22%),
41 spleen n=31 (7.7%), intestine n =5 (1.50%) and heart n=4 (1%). On the other hand, in the carcass
42 convictions, tuberculosis prevailed with 66.7% (n=2), followed by brucellosis with 33.3% (n=1) of
43 the causes of total conviction. Injuries with the highest intensity of viscera condemnations were:
44 Urinary cyst n=67 (43.42%), Telangiectasia n=56 (59.55%), Pulmonary emphysema n=40 (36.36%),
45 Renal ischemia n=43 (25.65%), and pulmonary congestion n=32 (31.81%). It is concluded that during
46 the 48 months of studies, the health of the animals slaughtered in the municipal slaughterhouse of
47 Açailândia was in favorable conditions for meat production for the consumer market, since the
48 number of carcasses condemned by zoonosis presented low proportions of occurrence.

49 **Keywords:** Condemnation – Health Inspection – Public Health

50

51 RESUMEN

52 El objetivo de este estudio fue reportar las principales causas de condenación de vísceras y canales
53 en bovinos sacrificados en un matadero municipal bajo inspección estatal (SIE), en el estado de
54 Maranhão, Brasil. Para la realización de este estudio, se tabularon todos los datos de condenación
55 correspondientes a los años 2021 y 2022, utilizando los registros diarios de condenación de canales
56 y vísceras del matadero frigorífico. Durante el período evaluado, se registró el sacrificio de 3.432
57 bovinos, con 2.245 animales sacrificados en 2021 y 1.185 en 2022, de los cuales se registraron n=413
58 (100%) condenas, siendo n=410 (99,3%) correspondientes a condena de vísceras y n=3 (0,7%) a
59 condena total de canales bovinos. En las condenaciones de vísceras, el órgano más afectado fue el
60 riñón, con 161 casos, correspondientes al 37,5%, seguido por pulmón n=116 (27,1%), hígado n=93
61 (22%), bazo n=31 (7,7%), intestino n=5 (1,5%) y corazón n=4 (1%). Por otro lado, en las
62 condenaciones de canales, predominó la tuberculosis con 66,7% (n=2), seguida de la brucelosis con
63 33,3% (n=1) de las causas de condenación total. Las lesiones con mayor intensidad de condenación
64 de vísceras fueron: quiste urinario n=67 (43,42%), telangiectasia n=56 (59,55%), enfisema pulmonar
65 n=40 (36,36%), isquemia renal n=43 (25,65%) y congestión pulmonar n=32 (31,81%). Se concluye
66 que, durante los 48 meses de estudio, la salud de los animales sacrificados en el matadero municipal
67 de Açailândia presentó condiciones favorables para la producción de carne destinada al mercado
68 consumidor, ya que el número de canales condenadas por zoonosis presentó bajas proporciones de
69 ocurrencia.

INTRODUCTION

According to the recommendations of the World Organisation for Animal Health, animals intended for transport must be clinically healthy and physically fit for travel. Handlers must be trained in animal behavior and welfare practices, avoiding the use of methods that cause pain, stress, or injuries. The use of electric prods should be restricted to exceptional situations (WOAH, 2023).

Therefore, bovine slaughter must be properly conducted not only to ensure animal welfare but also to guarantee food safety (Santos *et al.*, 2019; Silva *et al.*, 2022). In Brazil, the industrial and sanitary inspection of products of animal origin is regulated by Decree No. 9,013 of March 29, 2017, which establishes standards for sanitary inspection and control during slaughter and processing (Brazil, 2017).

On the global stage, it is estimated that one in ten people becomes ill after consuming contaminated food, resulting in approximately 420,000 deaths annually. Children under five years of age are disproportionately affected, accounting for approximately 125,000 deaths each year (WHO, 2024). Some of the foodborne diseases are considered zoonoses, where the diseases that most affect cattle in Brazil that cause condemnation are brucellosis, tuberculosis, pneumonia, bronchitis, and adenitis (Rossi *et al.*, 2014; Leite *et al.*, 2022; Ciui *et al.*, 2023). Organ condemnations recorded during post-mortem inspection are important indicators of animal health status and slaughter management practices. These condemnations may be associated with pathological lesions, zoonotic diseases, contamination, and operational failures occurring during handling and slaughter procedures (Leite *et al.*, 2022; Ciui *et al.*, 2023).

In addition to public health concerns, carcass and organ condemnations result in significant economic losses throughout the meat production chain. These losses are associated with reductions in carcass yield, depreciation of slaughterhouse products, restrictions on commercialization due to alterations in meat quality, and decreased profitability for producers. Furthermore, failures during pre-slaughter handling and slaughter operations may negatively affect hot carcass weight and increase the frequency of condemnations, thereby reducing the economic return of cattle production systems (Rodrigues *et al.*, 2022; Ciui *et al.*, 2023).

In addition, Ordinance No. 185/2008 established the Permanent Technical Commission on Animal Welfare within the Ministry of Agriculture. The commission aims to coordinate animal welfare actions and promote the adoption of good welfare practices by livestock producers. Adequate pre-slaughter handling is essential because poor management practices can increase animal stress,

103 compromise meat quality, and result in economic losses for producers and the meat industry (Grandin,
104 2022).

105 Therefore, carcass and organ condemnations should be minimized through the
106 implementation of good management and manufacturing practices throughout the production chain,
107 including animal handling, transport, and slaughter procedures. Condemnations identified during
108 meat inspection may result from pathological conditions, contamination, welfare-related problems,
109 or failures occurring during animal transport, pre-slaughter handling, and slaughter operations (Ciui
110 *et al.*, 2023; Nicolaisen *et al.*, 2023). The occurrence of such failures can compromise carcass quality,
111 food safety, and the economic sustainability of the meat production chain.

112 It is important to highlight that studies such as this provide valuable epidemiological data that
113 can be used to estimate the prevalence of diseases in slaughtered animals. By associating inspection
114 findings with the geographical origin of the animals, it is possible to identify disease distribution
115 patterns, assess the health status of specific regions, and support the development of public policies
116 aimed at improving animal and public health. Furthermore, slaughterhouses can serve as important
117 surveillance centers for monitoring livestock diseases, zoonoses, animal welfare, and food safety
118 issues (García-Díez *et al.*, 2023).

119 Thus, the present study aims to demonstrate the main causes of carcass and viscera
120 condemnation in a refrigerated slaughterhouse under state inspection, in the municipality of
121 Açailândia, Maranhão, Brazil, between the periods of January 2021 and April 2022.

123 MATERIALS AND METHODS

125 The present study was carried out in a beef slaughterhouse located in the city of Açailândia,
126 Maranhão, Brazil, with a slaughter capacity of 12 cattle per hour, 20 cattle per day, and 240 cattle per
127 month, under the State Inspection Service regime (SIE). The data used are from slaughter carried out
128 between January 2021 and September 2022. The sources of information used were separate inspection
129 sheets and reports according to the batches of animals received and filled in on all days of slaughter.

130 Monthly records of carcass and viscera condemnation from the slaughterhouse Frigorífico
131 Municipal Olindo Chaves were used to carry out the data collection, through the inspection forms
132 and reports filled out daily in the slaughter routine by a veterinarian and inspection assistants duly
133 trained to identify changes in carcasses and viscera. The information was organized according to the
134 animal category. The data collected during the evaluated period include the slaughter of 2,245
135 slaughters in 2021 and 1,185 slaughters in 2022, totaling 3,432 slaughters of cattle, aged between 3
136 and 6 years, of which total condemnations of carcasses and viscera were recorded.

137 To obtain the data, weekly, during all the days of cattle slaughter, two types of inspection were
138 carried out: the *antemortem* inspection and the *post-mortem* inspection carried out by the Veterinary
139 Doctors of the State Agency for Agricultural Defense of Maranhão (AGED) and the Technical
140 Responsible (RT) of the slaughterhouse.

141 The ante-mortem examination was performed before slaughter and divided into two stages.
142 The first stage consisted of the inspection of animals during unloading and reception at the
143 slaughterhouse. Documentary inspection was carried out through the Animal Transit Guide (GTA)
144 (Brasil, 2024), together with verification of the number of animals received. Subsequently, the
145 animals were separated into homogeneous groups according to their category for clinical evaluation.
146 Animals presenting conditions that prevented normal slaughter were directed to emergency slaughter,
147 whereas those suspected of disease were transferred to an isolation pen for clinical evaluation and
148 confirmation of diagnosis through laboratory tests when necessary.

149 The second ante-mortem inspection was conducted after the 12-hour fasting period adopted
150 by the slaughterhouse to assess the sanitary status of the animals and determine their suitability for
151 slaughter. Animals considered fit for slaughter were stunned using a pneumatic penetrating captive
152 bolt. Following exsanguination, post-mortem inspection was performed during the dressing and
153 evisceration stages. Examinations were conducted by trained official inspection personnel through
154 visual inspection, palpation, and, when necessary, incision of organs and carcasses, in accordance
155 with the official meat inspection procedures established by the Ministry of Agriculture and Livestock
156 (MAPA) (Brasil, 2017a).

157 Carcasses and viscera presenting abnormalities or significant lesions were removed from the
158 slaughter line and referred to the Final Inspection Department (DIF). The official veterinarian was
159 responsible for the final evaluation and determination of the appropriate destination of carcasses
160 and/or viscera, including total condemnation, partial condemnation, or conditional use, in accordance
161 with current legislation.

162 All changes found during this period were noted on a specific conviction slip, and later this
163 information was transferred and processed in Microsoft Excel spreadsheets. The quantitative results
164 were tabulated and interpreted, with the macroscopic alterations found grouped according to the
165 affected organs, and subsequently, this information obtained from condemnation was forwarded to
166 the Board of Inspection of Products of Plant and Animal Origin (DIPOVA) for control.

167 **Ethical Statement:** The present study was based exclusively on secondary data obtained from
168 routine ante-mortem and post-mortem inspections conducted at the slaughterhouse by the official
169 veterinarian responsible for sanitary inspection and technical supervision of the establishment. The
170 researchers did not perform any intervention, handling, manipulation, or experimental procedures
171 involving the animals. Data collection was carried out through access to official slaughterhouse

172 records provided by the technical veterinarian as part of a research collaboration. Therefore, the study
173 did not influence the management, welfare, or slaughter procedures routinely adopted by the
174 establishment. As the study was based solely on retrospective analysis of records routinely generated
175 during official sanitary inspection activities, with no direct involvement of animals by the research
176 team, approval by an Animal Ethics Committee was not required according to the applicable
177 institutional guidelines.

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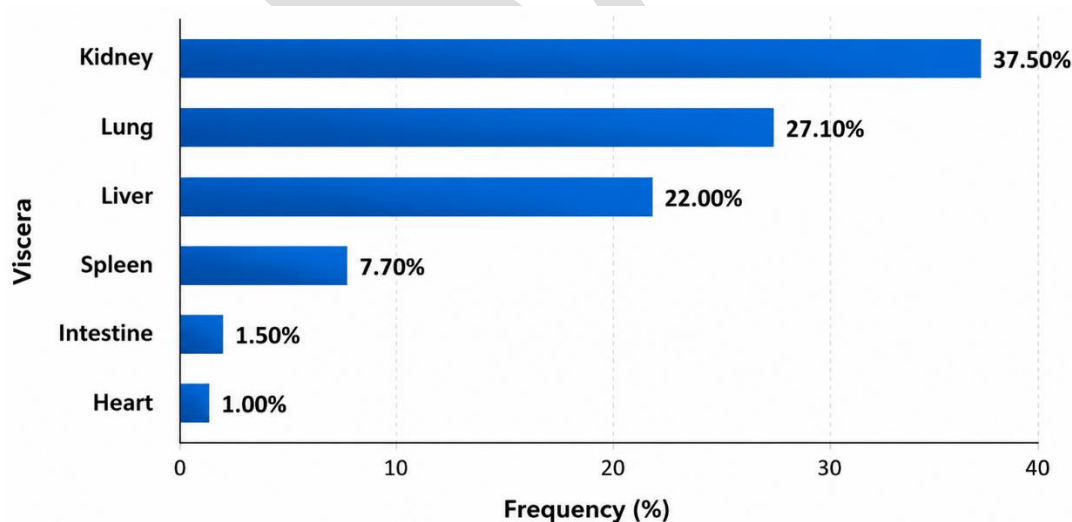
179 RESULTS

180 From January 2021 to September 2022, a total of 3,432 cattle were slaughtered in a
181 slaughterhouse located in Açailândia, Maranhão. Although animals of both sexes were slaughtered,
182 the number of females was higher than that of males.

183 Of the 3,432 slaughtered cattle, 413 condemnations were recorded. Of these, 99.3%
184 corresponded to viscera condemnations and 0.7% to total carcass condemnations. Regarding total
185 carcass condemnations, tuberculosis was the most frequent cause, accounting for 66.7% (n = 2) of
186 the cases, followed by brucellosis, which represented 33.3% (n = 1) of the condemnations.

187 The viscera condemnations of the period studied are listed in Figure 2.

188



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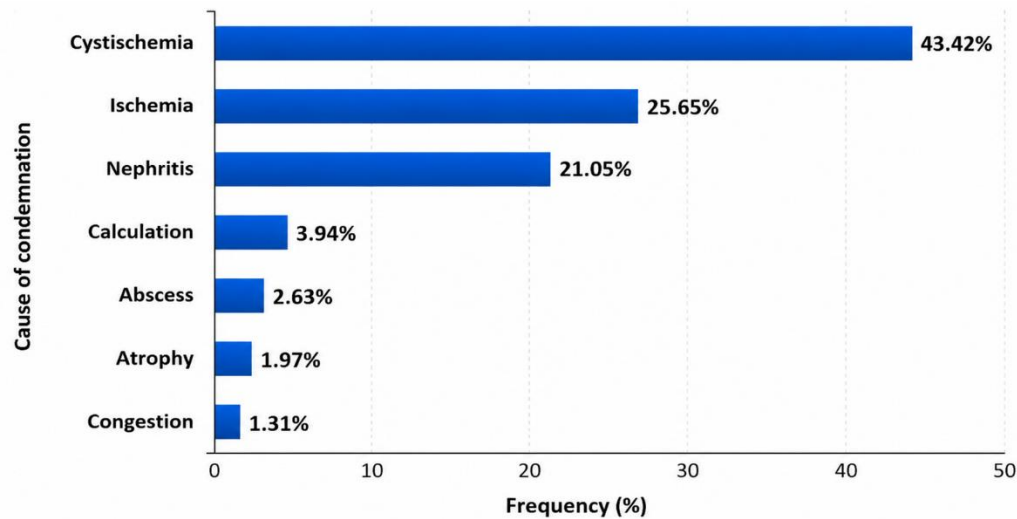
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191 **Figure 1.** Distribution of viscera condemnation in a beef slaughterhouse in Açailândia, Maranhão,
192 Brazil, 2024.

193

194 The kidney was the most condemned organ due to the presence of cysts (Figure 2).

195



197

198

Figure 2. Main causes of kidney condemnation, Acailândia, Maranhão, Brazil.

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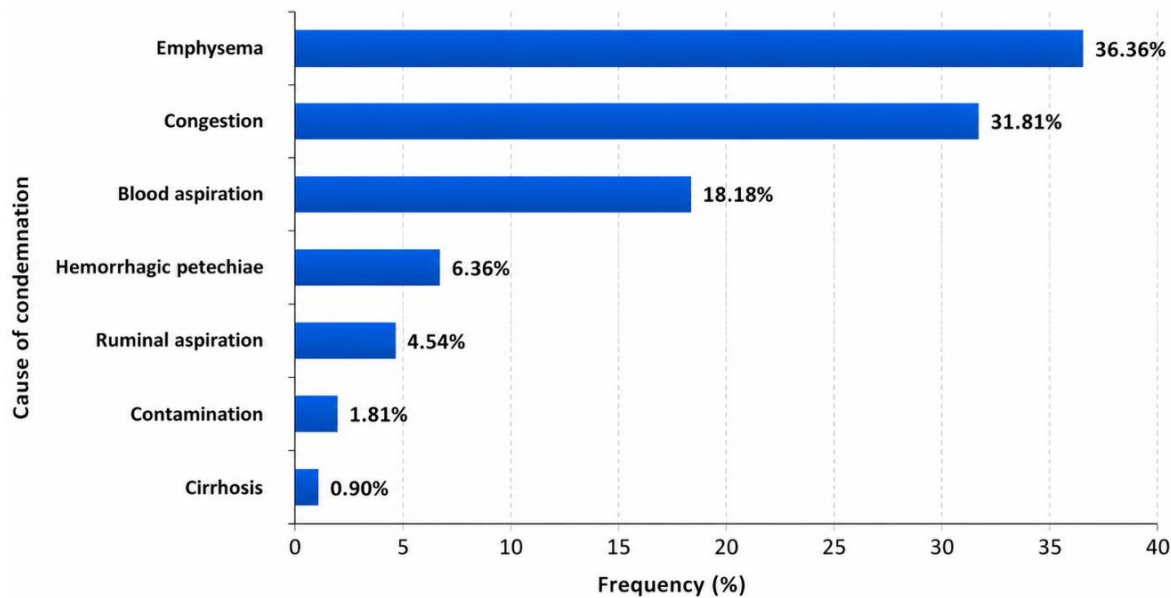
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The organ that received the second-highest condemnation was the lung. The main causes of pulmonary condemnation are related to the respiratory portion (Figure 3). Having is the main cause of the occurrence of emphysema, congestion, and aspiration of blood.



204

205

Figure 3. Main causes of lung condemnation, Acailândia, Maranhão, Brazil.

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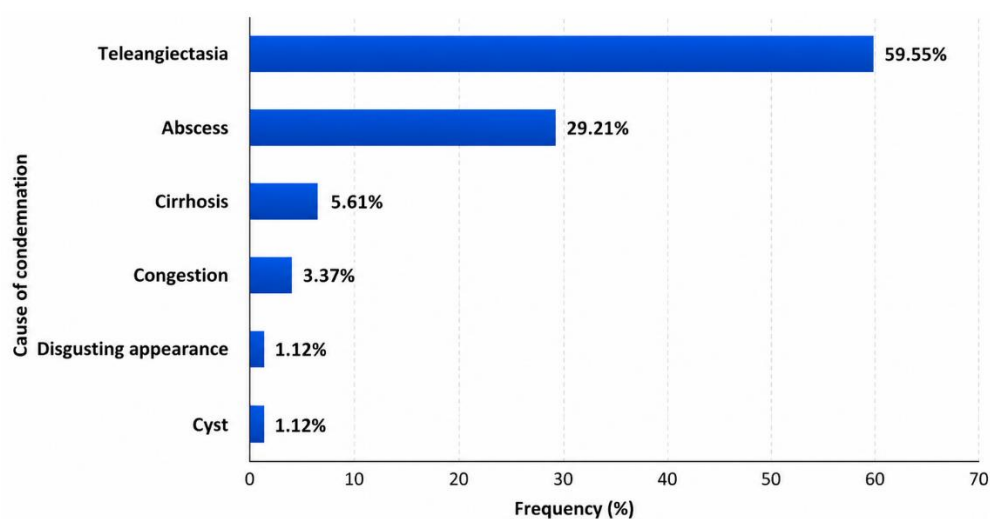
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Liver condemnations accounted for 22% of viscera condemnations (Figure 4). Liver abscesses in this study were the second leading cause of liver condemnation (Figure 5).

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211



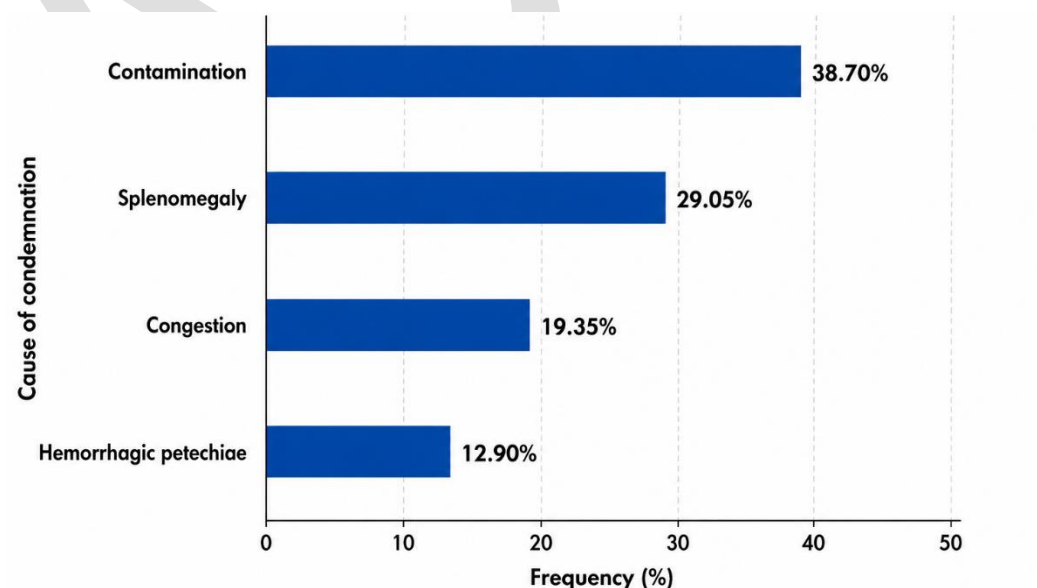
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213 **Figure 4.** Main causes of liver condemnation, Acailândia, Maranhão, Brazil.

214

215 In this study, spleen condemnations accounted for 7.7% of the total viscera condemnations
216 (Figure 1), with contamination the most prevalent at 38.7% and splenomegaly at 29.0% (Figure 5).
217 Condemnations of the heart corresponded to 1% of condemnations of the viscera, with Pericarditis
218 being the main cause of disposal of this organ.

219



220

221 **Figure 5.** Main causes of spleen condemnation, Acailândia, Maranhão, Brazil.

222

223

224 Condemnations of stomachs and intestines accounted for 1.5% of the condemnations of
 225 viscera, with Esophagostomosis accounting for 100% of the causes of disposal.

226 The destination that carcasses and viscera must receive after inspection (Table 1).
 227

228 **Table 1.** Destination of condemned carcasses and viscera in a slaughterhouse in Açailândia,
 229 Maranhão, Brazil, 2024.

	Pathologies	Disposal of carcasses and viscera
Carcasses	generalized tuberculosis	Sentenced to Incineration
	generalized brucellosis	
GUTS	Congestion	Sentenced to rendering
	Contaminacion	
	Urinary Cyst	
	Hepatic Cyst	
	Pulmonary Emphysema	
	Liver abscess	
	Kidney abscess	
	Pericarditis	
	Telangiectasia	
	Blood aspiration	
	Ruminal aspiration	
	Kidney stone	
	Esophagostomy	
	Ischemia	
	Hemorrhagic petechiae	
	Splenomegaly	
	Cirrhosis	
	Atrophy	
	Disgusting appearance	
	Nephritis	

230

231

232 **DISCUSSION**

233 A higher proportion of females was observed among slaughtered animals. Although
234 information regarding the production system and management practices of the source farms was not
235 available, this result may be associated with culling strategies commonly adopted in cattle production
236 systems. In practice, female cattle are often removed from the herd due to advanced age, reproductive
237 failure, low productive performance, health problems, or replacement by younger and more
238 productive animals.

239 However, the specific reasons for culling were not evaluated in the present study. Previous
240 studies have reported that cows may be culled due to advanced age, low productivity, economic
241 decisions by farmers, and disorders affecting the mammary gland, reproductive tract, or locomotor
242 system (Silva *et al.*, 2004). More recently, Grala *et al.* (2025) identified reproductive disorders,
243 mastitis, high somatic cell counts, and locomotor problems as the main reasons for culling in dairy
244 herds. However, in the present study, the reasons for culling were not recorded, and therefore, it is
245 not possible to determine the factors responsible for the higher frequency of female slaughter
246 observed.

247 The main cause of total carcass condemnation observed in the present study was tuberculosis.
248 The occurrence of this zoonosis in slaughtered cattle highlights the importance of maintaining
249 effective surveillance and control measures within livestock production systems. In Brazil, the
250 National Program for the Control and Eradication of Brucellosis and Animal Tuberculosis (PNCEBT)
251 was established to reduce the prevalence and incidence of these diseases, minimize their impact on
252 animal and public health, and contribute to the competitiveness of the national livestock sector
253 (Brasil, 2017b; MAPA, 2024). The PNCEBT is based on integrated control measures for both
254 brucellosis and bovine tuberculosis, including diagnostic testing, certification of disease-free herds,
255 epidemiological surveillance, and sanitary control measures. In addition, the program requires the
256 mandatory vaccination of female calves against brucellosis between three and eight months of age
257 using the B19 or RB51 vaccines (Brasil, 2017b; Brasil, 2021; MAPA, 2024).

258 In studies carried out in southeastern Brazil, Almeida *et al.* (2017) and Camba & Alves (2020)
259 reported lower rates of total carcass condemnation than those observed in the present study, with
260 complete carcass condemnation occurring in 0.24% and 0.18% of slaughtered cattle, respectively.
261 Differences among studies may be associated with variations in the prevalence of diseases,
262 management practices, and regional sanitary conditions.

263 In the present study conducted in Açailândia, Maranhão, Brazil, lesions suggestive of bovine
264 tuberculosis were the main cause of total carcass condemnation. This finding may be related to the
265 severity and systemic nature of the disease, which often requires the complete rejection of the carcass
266 during post-mortem inspection. In contrast, several other pathological conditions commonly detected
267 in slaughterhouses frequently result in partial condemnation of organs or specific carcass portions

rather than total carcass rejection. Similar studies conducted in Brazil have highlighted bovine tuberculosis as an important cause of total carcass condemnation and associated economic losses in the meat industry (Leite *et al.*, 2022; Quevedo *et al.*, 2026).

The predominance of lesions suggestive of bovine tuberculosis among the causes of total carcass condemnation is particularly relevant from a public health perspective. Tuberculosis is a zoonotic disease of major concern, and its detection during post-mortem inspection highlights the importance of slaughterhouses as critical control points for protecting consumers and monitoring animal health. In addition to tuberculosis, other zoonotic diseases associated with meat consumption, such as salmonellosis and cysticercosis, have also been recognized as important causes of carcass or organ condemnation in Brazil (Rossi *et al.*, 2014; García-Díez *et al.*, 2023; World Health Organization, 2024). These diseases represent a significant public health concern due to their potential transmission to humans through contaminated animal products.

Both bovine cysticercosis and tuberculosis may remain undetected at the farm level, particularly when infected animals do not present evident clinical signs. Consequently, these diseases are frequently identified only during post-mortem inspection at slaughterhouses, resulting in the condemnation of carcasses and organs and generating significant economic losses for producers and the meat industry (García-Díez *et al.*, 2023; Nicolaisen *et al.*, 2023).

In addition to lesions associated with zoonotic diseases, renal alterations also contributed to organ condemnation in the present study. The frequency of kidney condemnation due to cysts suggests that cystic renal lesions are relatively common among cattle slaughtered in the Tocantina Region of Maranhão. These lesions are generally not detected in live animals because they are often asymptomatic and are usually identified only during post-mortem inspection. According to Reece (2006) and Klein (2020), structural alterations affecting nephrons may compromise normal renal architecture and function. Furthermore, cystic renal lesions are characterized by progressive dilation of renal structures and may impair kidney function depending on their size and distribution (Zachary, 2022). In the present study, these lesions were detected only during post-mortem inspection, highlighting the importance of slaughterhouse surveillance for identifying abnormalities that often remain undetected in live animals and ensuring the sanitary quality of products intended for human consumption.

The etiology of renal cysts is complex and may involve developmental, hereditary, and degenerative factors. Previous studies have reported that cystic lesions may arise from abnormalities in renal tubular development or progressive structural alterations affecting renal tissue (Zachary, 2022). In the present study, the factors associated with the occurrence of renal cysts could not be determined because information regarding animal age, genetic background, management practices, and clinical history was not available. Furthermore, no histopathological examination was performed

303 to characterize the lesions. Nevertheless, renal cysts are commonly reported findings during post-
304 mortem inspection and are often considered incidental lesions, particularly in older animals.

305 According to the Brazilian Regulation for the Industrial and Sanitary Inspection of Products
306 of Animal Origin (RIISPOA), lungs presenting pathological lesions detected during post-mortem
307 inspection are subject to sanitary judgment, and condemnation is determined according to the nature,
308 extent, and public health significance of the lesions (Brasil, 2017a). In the present study, pulmonary
309 emphysema and congestion were the main causes of lung condemnation. Similar findings have been
310 reported by Almeida *et al.* (2017), who identified pulmonary emphysema among the most frequent
311 pulmonary lesions detected during meat inspection. Likewise, studies conducted in slaughterhouses
312 have shown that respiratory alterations, particularly emphysema and congestion, are among the most
313 common causes of lung rejection in cattle, resulting in economic losses due to the disposal of edible
314 by-products (Leite *et al.*, 2022; Ciui *et al.*, 2023). These lesions may be associated with events
315 occurring during handling, transport, stunning, and slaughter procedures, highlighting the importance
316 of adequate animal welfare and slaughter practices.

317 The high frequency of pulmonary emphysema and congestion observed in the present study
318 may be associated with factors related to animal handling before slaughter, transportation conditions,
319 stunning procedures, and the bleeding process. Inadequate pre-slaughter management can induce
320 physiological stress responses and respiratory alterations that contribute to the occurrence of
321 pulmonary lesions detected during post-mortem inspection. Previous studies have highlighted that
322 animal welfare conditions during transport and slaughter directly influence the occurrence of
323 pathological findings and carcass quality (Grandin, 2022; Nicolaisen *et al.*, 2023). Furthermore, stress
324 experienced immediately before slaughter may compromise animal welfare and increase the
325 incidence of lesions that result in organ condemnation and economic losses for the meat industry
326 (Terlouw & Gagaoua, 2023).

327 Pulmonary emphysema is characterized by abnormal distension of the alveoli caused by the
328 accumulation of air within the pulmonary tissue, which may compromise normal respiratory
329 architecture and function (Klein, 2020). During slaughterhouse inspection, emphysematous lungs are
330 typically enlarged, pale, and crepitant on palpation, which frequently results in organ condemnation.
331 The occurrence of pulmonary emphysema has been associated with events occurring during pre-
332 slaughter handling, stunning, bleeding, and other slaughter procedures, making it one of the most
333 common non-infectious lesions identified during post-mortem inspection (Almeida *et al.*, 2017; Ciui
334 *et al.*, 2023).

335 Similarly, pulmonary blood aspiration may lead to lung condemnation because affected areas
336 exhibit marked red discoloration resulting from the presence of blood within the airways and
337 pulmonary parenchyma. Such lesions are often associated with failures during bleeding procedures

338 and may compromise the commercial value and hygienic quality of the organ (Roça *et al.*, 2021).
339 Therefore, adequate employee training and the implementation of good slaughter practices are
340 essential to minimize operational failures and reduce unnecessary organ condemnations, thereby
341 improving both economic efficiency and animal welfare outcomes (Grandin, 2022; Nicolaisen *et al.*,
342 2023).

343 Operational failures during slaughter may contribute substantially to the condemnation of
344 edible organs and by-products, resulting in avoidable economic losses for the meat industry.
345 Inadequate handling, ineffective stunning, and deficiencies during the bleeding process can lead to
346 lesions such as pulmonary emphysema, blood aspiration, and contamination of organs, thereby
347 increasing condemnation rates (Roça *et al.*, 2021). These findings emphasize the importance of
348 employee training and strict adherence to animal welfare and slaughter protocols throughout the
349 production chain (Grandin, 2022; Nicolaisen *et al.*, 2023). In addition to their economic implications,
350 operational failures may compromise animal welfare by increasing the risk of unnecessary stress and
351 suffering during slaughter (Terlouw & Gagaoua, 2023).

352 Proper exsanguination is another critical factor influencing carcass and organ quality.
353 Efficient bleeding reduces the amount of residual blood retained in tissues, thereby improving the
354 hygienic quality, appearance, and shelf life of meat products. Inadequate bleeding may contribute to
355 tissue congestion and increase the likelihood of organ condemnation during post-mortem inspection.
356 Although bleeding time and the interval between stunning and exsanguination were not evaluated in
357 the present study, the occurrence of congestion in condemned organs underscores the importance of
358 proper slaughter procedures and effective post-mortem inspection to ensure meat quality and
359 compliance with the sanitary requirements established by the Brazilian RIISPOA (Brasil, 2017a;
360 WOA, 2023).

361 Liver condemnation is among the most common findings during post-mortem inspection and
362 may result from parasitic infections, abscesses, fibrosis, congestion, and other pathological alterations
363 that compromise organ quality and safety. Previous studies conducted in slaughterhouses have
364 reported parasitic lesions and hepatic abscesses among the leading causes of liver condemnation in
365 cattle (Tiradentes *et al.*, 2017; Leite *et al.*, 2022; Ciui *et al.*, 2023). The occurrence of such lesions
366 highlights the importance of adequate herd health management and disease control strategies at the
367 farm level.

368 Hepatic abscesses are frequently identified as incidental findings during slaughter inspection;
369 however, when severe or multiple, they may result in organ condemnation and economic losses.
370 According to Amachawadi & Nagaraja (2016), the development of liver abscesses in feedlot cattle is
371 commonly associated with high-concentrate diets, which may predispose animals to ruminal acidosis
372 and subsequent bacterial translocation to the liver. Similarly, Mendes & Pilati (2007) reported a

373 higher frequency of hepatic abscesses in intensively raised and confined cattle compared with pasture-
374 raised animals. Although feeding practices were not evaluated in the present study, these findings
375 suggest that nutritional management may influence the occurrence of hepatic lesions detected during
376 post-mortem inspection.

377 Regarding spleen condemnation, the findings of the present study differed from those reported
378 by Mota *et al.* (2021), who identified neoplasia as the primary cause of spleen rejection in cattle
379 slaughtered in Minas Gerais, Brazil. In contrast, contamination and splenomegaly were the most
380 frequent causes of spleen condemnation observed in the present study. These differences may reflect
381 variations in regional sanitary conditions, slaughterhouse practices, and the characteristics of the
382 evaluated animal populations.

383 Contamination of the spleen is generally associated with operational failures during slaughter,
384 particularly during skinning, evisceration, and carcass handling procedures. Inadequate hygienic
385 practices and insufficient employee training may increase the risk of contamination, resulting in organ
386 condemnation and economic losses (Silva *et al.*, 2016; Ciui *et al.*, 2023).

387 Splenomegaly and splenic congestion may be associated with circulatory disturbances and
388 failures during the bleeding process. Inefficient exsanguination can lead to blood retention within
389 organs, contributing to congestion and enlargement of the spleen observed during post-mortem
390 inspection (Vieira *et al.*, 2011). Although bleeding efficiency was not evaluated in the present study,
391 these findings reinforce the importance of adequate slaughter procedures to minimize avoidable organ
392 condemnations.

393 Pericarditis was the main cause of heart condemnation observed in the present study. This
394 condition is characterized by inflammation of the pericardium and may result in fibrous adhesions
395 between the pericardial sac and adjacent cardiac structures, compromising the normal appearance and
396 sanitary quality of the organ (Mota *et al.*, 2021). Similar findings have been reported in
397 slaughterhouse studies, where inflammatory cardiac lesions represent an important cause of heart
398 rejection during post-mortem inspection.

399 According to the Brazilian Regulation for the Industrial and Sanitary Inspection of Products
400 of Animal Origin (RIISPOA) (Brasil, 2017a), cardiac lesions such as pericarditis, myocarditis, and
401 endocarditis are subject to sanitary judgment during post-mortem inspection. Depending on the
402 nature, extent, and severity of the lesions, the affected organs may be condemned, whereas the carcass
403 may be approved for human consumption provided there is no evidence of systemic involvement or
404 generalized disease. Therefore, post-mortem inspection plays a fundamental role in identifying
405 cardiac lesions, assessing their public health significance, and ensuring that meat products comply
406 with sanitary standards.

407 Esophagostomosis was the only cause of stomach and intestine condemnation observed in the
408 present study. Gastrointestinal parasitic infections remain an important cause of organ condemnation
409 in cattle and may negatively affect animal health, welfare, and productivity. Although digestive
410 lesions associated with bovine tuberculosis may occur following the ingestion of infected respiratory
411 secretions or as a consequence of systemic dissemination of *Mycobacterium bovis* Karlson & Lessel,
412 1970, no condemnations of stomachs or intestines suggestive of tuberculosis were identified in the
413 present study (García-Díez *et al.*, 2023; Quevedo *et al.*, 2026). This finding may indicate a low
414 occurrence of advanced gastrointestinal involvement among the slaughtered animals.

415 The post-mortem inspection of bovine carcasses, organs, and edible by-products is an essential
416 component of sanitary surveillance and is conducted according to the criteria established by the
417 Brazilian RIISPOA (Brasil, 2017c). Through this inspection process, pathological lesions and
418 conditions that may compromise food safety and public health can be identified and appropriately
419 managed.

420 Despite the limitations associated with the use of slaughterhouse condemnation records, these
421 data provide valuable information regarding the health status of slaughtered populations, the
422 occurrence of diseases of veterinary and public health importance, and the effectiveness of sanitary
423 control measures implemented throughout the production chain.

424 It can be concluded that, during the 48-month study period, the frequency of total carcass
425 condemnations associated with zoonotic diseases was relatively low in cattle slaughtered at the
426 municipal slaughterhouse of Açailândia, Maranhão, Brazil. However, organ condemnations were
427 frequent, with the kidneys being the most affected organs, followed by the lungs, liver, and spleen.
428 These findings highlight the importance of post-mortem inspection as a tool for monitoring animal
429 health conditions and ensuring food safety.

430 The principal causes of organ condemnation were associated with pathological lesions
431 affecting different organ systems, including parasitic, inflammatory, and degenerative conditions.
432 Although the factors contributing to the occurrence of these lesions were not evaluated in the present
433 study, the results reinforce the importance of adequate herd health management, sanitary control
434 measures, and good production practices to reduce organ condemnation rates and associated
435 economic losses.

436 The findings of this study also emphasize the importance of continuous training of
437 slaughterhouse personnel and the implementation of good slaughter and hygiene practices to
438 minimize avoidable organ condemnations and improve processing efficiency. Furthermore,
439 slaughterhouse condemnation records represent a valuable source of epidemiological information and
440 can support sanitary surveillance programs, contributing to the monitoring, control, and prevention
441 of diseases of veterinary and public health importance. Future studies integrating slaughterhouse data

442 with on-farm health and management information may provide a more comprehensive understanding
443 of the factors associated with organ and carcass condemnations in cattle.

444

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- 564 Received March 23, 2026.
- 565 Accepted July 7, 2026.