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Paper

Post-mortem carcass and organ condemnations in cattle, sheep, and goats slaughtered at the Béjaïa abattoir, Algeria: Causes and associated economic losses over a 10-year period

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Abstract

This ten-year retrospective study (2012–2021) aimed to investigate the major causes of organ and carcass condemnations identified during post-mortem meat inspection of cattle, sheep, and goats slaughtered at the municipal abattoir of Béjaïa, Algeria, and to estimate the associated economic losses. A total of 140,024 animals were inspected, including 31,723 cattle, 48,700 sheep, and 59,601 goats. Overall, 33,362 organs (24.1%) were condemned, and 399 carcasses (0.3%) were partially or wholly condemned. The highest rate of organ and carcass condemnation was recorded in cattle (32.4%), followed by sheep (24.7%) and goats (19.2%) ($P < 0.001$). Across all three species, the lungs were the most frequently condemned organs (n = 25,272; 75.7%), followed by the liver (n = 2,899; 8.7%) and heart (n = 2,432; 7.3%) ($P < 0.001$). In cattle, bovine tuberculosis was the leading cause of organ and carcass condemnation. Liver abscesses represented the main cause of liver condemnation in cattle, sheep, and goats, accounting for 462 of 1,537, 400 of 730, and 389 of 632 condemned livers, respectively. In contrast, pericarditis was the most common cause of heart condemnation in sheep and goats. Over the study period, the estimated direct economic losses attributable to organ and carcass condemnations amounted to USD 518,396.6 in cattle, USD 56,297.5 in sheep, and USD 46,395.8 in goats. These findings highlight the importance of strengthening preventive animal health measures, improving livestock management practices, and reinforcing meat inspection systems to safeguard public health while minimising economic losses across the livestock production chain.

Keywords

Algeria, bovine tuberculosis, economic losses, fasciolosis, hydatidosis , meat inspection

Introduction

Livestock play a vital role in human livelihoods worldwide by providing high-quality dietary protein through meat and milk, as well as valuable products such as wool and leather. However, these animals can serve as reservoirs of a wide range of zoonotic pathogens, including bacteria, viruses, and parasites, which are responsible for approximately two-thirds of all human infectious diseases (Jones et al., 2008; Chomel, 2009; Rahman et al., 2020). Zoonotic pathogens are commonly present in animals presented for slaughter, raw hides and skins, blood, and the farm environment. Among the various transmission routes, meat and meat products are among the most important vehicles for pathogens transmissible to humans, resulting in diseases collectively referred to as meat-borne diseases (Ghatak, 2020; Nielsen et al., 2021). These pathogens may enter the food chain either through infected animals or through

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cross-contamination arising from inadequate hygiene practices and unsanitary conditions during meat processing, handling, and distribution (Ijaz et al., 2021). In this context, meat inspection at slaughterhouses represents a critical component of animal disease surveillance and public health protection. It facilitates the detection and prevention of important meat-borne zoonoses, including bovine tuberculosis, brucellosis, hydatidosis, and cysticercosis (Ninios et al., 2014; Vial, 2019; Khedri et al., 2021). In Algeria, red meat production is derived primarily from sheep (56%), cattle (34%), and goats (8%) (Zemour et al., 2020). Annual domestic output is estimated at approximately 300,000 tonnes, mainly beef and mutton, supplemented by imports of about 40,000 tonnes of frozen beef, representing nearly 12% of national consumption (Bessaoud et al., 2019). Despite a beef self-sufficiency rate of approximately 55%, local production remains insufficient to satisfy the increasing demand driven by population growth and changing dietary habits (Sadoud and Hocquette, 2022). Consequently, Algeria has become increasingly dependent on imports of both live animals and meat products. In 2024, imports reached approximately 100,000 tonnes of fresh or chilled red meat (beef and mutton), while nearly two million sheep were imported for slaughter during the 2025 and 2026 Eid al-Adha celebrations (Algérie Presse Service, 2026). Algeria's dependence on meat imports imposes a substantial economic burden on the national economy. In addition, large numbers of organ and carcass condemnations are recorded annually in slaughterhouses, resulting in significant economic losses. These condemnations reflect not only the impact of infectious and parasitic diseases on animal health and productivity but also the sanitary and economic consequences associated with reduced meat quality, diminished market value of animal products, and potential risks to consumers arising from the consumption of unsafe meat. The present study aimed to identify the major causes of organ and carcass condemnations detected during *post-mortem* inspection of cattle, sheep, and goats slaughtered at the municipal abattoir of Béjaïa, Algeria, over a ten-year period (2012–2021). Furthermore, the study assessed the prevalence of the principal lesions and zoonotic diseases identified during meat inspection and estimated the economic losses associated with organ and carcass condemnations.

Materials and methods

Study area

The study was conducted in the province of Béjaïa (36°45′21″ N, 5°05′03″ E), located in north-eastern Algeria along the Mediterranean coast. The province covers an area of approximately 3,268 km², with elevations ranging from sea level to about 1,942 m above sea level at Mount Takoucht, the highest point in the province. Béjaïa is characterised by a Mediterranean climate, with mild, wet winters and hot, dry summers. The region receives an average annual rainfall of about 637 mm, and the mean annual temperature is approximately 18 °C (ANIREF, 2018). The livestock population is estimated at 24,200 cattle, 71,447 sheep, and 36,659 goats. The province includes five abattoirs and six slaughter slabs. The municipal abattoir has a daily slaughter capacity of approximately 50 cattle, 250 sheep, and 250 goats.

Animal population and meat inspection

The study population consisted of cattle, sheep, and goats slaughtered at the Béjaïa municipal abattoir between 2012 and 2021. A retrospective review of abattoir records was conducted to collect data on the number of animals slaughtered and the frequency and patterns of organ condemnations and partial or total carcass condemnations. Information regarding age, breed, body condition score, and geographical origin was unavailable in the abattoir records; therefore, only data on sex were included in the analysis. All animals were subjected to routine *ante-mortem* and *post-mortem* inspections performed by official veterinary inspectors in accordance with standard meat inspection procedures described by Herenda et al. (1994). Meat inspection was performed by official veterinary inspectors of the Directorate of Agricultural Services of the province Béjaïa under the supervision of the Directorate of Veterinary Services of the Ministry of Agriculture and Rural Development. During *post-mortem* examination, visceral organs, including the lungs, heart, liver, intestines, spleen, kidneys, and genital organs as well as accessible lymph nodes and carcasses, were systematically inspected through visual examination, palpation, and targeted incisions to detect cysts, nodules, parasitic infestations, and other lesions or abnormalities. In this study, lungs from animals diagnosed with foot-and-mouth disease (FMD) were systematically condemned in accordance with the sanitary meat inspection procedures applied at the slaughterhouse, although FMD does not typically produce gross pulmonary lesions. The respiratory tract is recognised as the primary site of FMD virus infection and persistence (Zhu et al., 2020). For the purposes of this study, the term hepatitis referred to diffuse inflammatory liver lesions characterized by gross changes in liver size, colour, and/or consistency observed during routine *post-mortem* meat inspection.

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Assessment of direct economic loss

Direct economic losses resulting from organ and carcass condemnations were estimated using the average market prices and weights of condemned carcasses and edible offal. Retail prices for edible offal (lungs, liver, kidneys, heart, and spleen), as well as the market prices per kilogram of beef and small-ruminant meat, were obtained through surveys conducted among local butchers in the Béjaïa region. Average market prices were calculated from the retail prices collected and were assumed to remain constant throughout the study period for the estimation of direct economic losses. The average weights of condemned carcasses and edible organs were obtained from routine slaughterhouse records. For cattle, the average organ weights were estimated at 5.0 kg for the lungs, 2.0 kg for the heart, 6.0 kg for the liver, 1.3 kg for the kidneys, and 0.8 kg for the spleen. The corresponding average weights for small ruminants were 1.0 kg, 0.8 kg, 0.7 kg, 0.1 kg, and 0.1 kg, respectively. Direct economic losses for each condemned organ or carcass were estimated by multiplying the average condemned weight by its corresponding retail market price.

The total economic losses resulting from organ and carcass condemnations were estimated using the following formula: TEL = CEL + OEL

where TEL represents the total economic losses, CEL represents the economic losses associated with carcass condemnations, and OEL represents the economic losses associated with offal condemnations.

Economic losses due to carcass condemnations were calculated as follows: CEL = ACP × ACW

where ACP is the average carcass price (USD/kg) and ACW is the average carcass weight (kg).

Economic losses due to offal condemnations were calculated using the following equation: OEL = NCO × AOP × AOW

where NCO is the number of condemned organs, AOP is the average market price of the organ (USD/kg), and AOW is the average organ weight (kg). All economic losses were converted from Algerian dinars (DZD) to United States dollars (USD) using the official exchange rate published by the Bank of Algeria (1 USD = 132.52 DZD).

Statistical analysis

Data extracted from slaughterhouse records and obtained through surveys were entered into a Microsoft Excel® spreadsheet (Microsoft Excel 2016, Microsoft Corp., Redmond, WA, USA), in which coding, cleaning, and validation procedures were performed prior to analysis. Descriptive statistics were used to summarise the data and to calculate organ and carcass condemnation rates, expressed as the proportion of condemned organs or carcasses relative to the total number of organs or carcasses examined. The dataset was subsequently exported to IBM SPSS® Statistics software (Version 26.0; IBM Corp., Armonk, NY, USA) for statistical analysis. The chi-squared (χ^2) test was used to assess differences in condemnation rates among animal species and among condemned organs and carcasses.

Results

Details of the ruminants slaughtered at the Béjaïa abattoir during the study period are presented in Figure 1. A total of 140,024 animals were subjected to *ante- mortem* and *post-mortem* sanitary inspections between 2012 and 2021, comprising 31,723 cattle (22.7%), 48,700 sheep (34.8%), and 59,601 goats (42.6%). The overwhelming majority of slaughtered animals were males (99.7%), whereas females accounted for only 0.3% of the total number of animals slaughtered.

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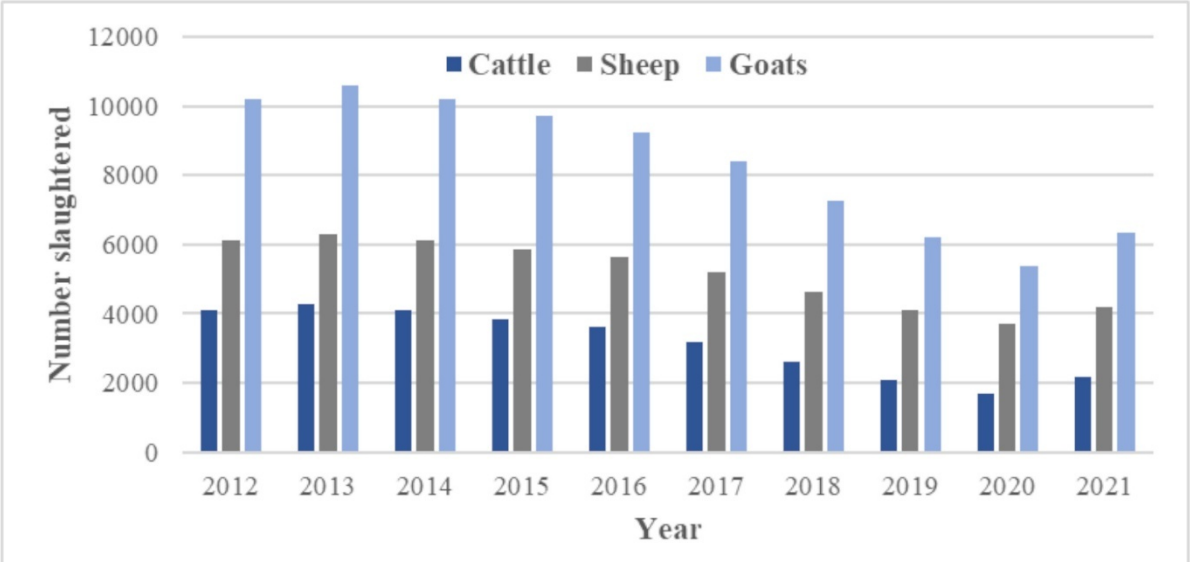

Figure 1. Temporal variation in the numbers of cattle, sheep, and goats slaughtered at the Béjaïa abattoir, Algeria, between 2012 and 2021.

The number of cattle and sheep slaughtered generally declined over the study period, whereas the number of goats slaughtered fluctuated markedly, with a pronounced peak in 2018. Sheep were the predominant species between 2012 and 2015, while goats became the predominant species from 2016 onwards and largely accounted for the observed annual variation in slaughter numbers. Overall, one or more lesions were identified in 33,761 animals (24.1%), resulting in the condemnations of 33,362 organs and 399 carcasses. Organ condemnations were significantly more frequent than carcass condemnations and differed markedly among animal species ($P < 0.001$). Among the condemned organs, the lungs accounted for 75.7% (25,272/33,362) of all organ condemnations, followed by the liver (8.7%), heart (7.3%), genital organs (3.8%), and head (1.7%) (Table I). Lung condemnations predominated in sheep (87.3%) and goats (90.0%), whereas cattle exhibited a more heterogeneous distribution of lesions, with condemnations involving the lungs (45.5%), heart (22.8%), and liver (15.4%). In contrast, condemnations of the kidneys, spleen, intestines, and head remained comparatively uncommon across all three species (Table I).

Organs/ Carcass		Cattle		Sheep ***		Goats ***		Total		P-value
		n = 31723	%	n = 48700	%	n = 59601	%	n = 140024	%	
Organ ***	Head	531	5.3	17	0.1	8	0.07	556	1.7	
	Lung	4537	45.5	10442	87.3	10293	90	25272	75.7	
	Heart	2273	22.8	110	0.9	49	0.4	2432	7.3	
	Liver	1537	15.4	730	6.1	632	5.5	2899	8.7	
	Spleen	144	1.4	62	0.5	42	0.4	248	0.7	0.000
	Intestine	270	2.7	16	0.1	6	0.05	292	0.9	
	Kidney	280	2.8	113	0.9	16	0.1	409	1.2	
	Genitalia organs	397	4	471	3.9	386	3.4	1254	3.8	
Total		9969		11961		11432		33362		
Carcass	Parts of carcass	260	87.8	60	74	17	77.3	337	84.5	
	Whole carcass	36	12.2	21	25.9	5	22.7	62	15.5	0.006
Total		296		81		22		399		

Table I. Distribution of organ and carcass condemnations in cattle, sheep, and goats slaughtered at the Béjaïa abattoir (2012–2021). ***$P < 0.001$. Percentages were calculated as the number of specific organs condemned divided by the total number of condemned animals.

Carcass condemnation rates also differed significantly among species ($P = 0.006$). Partial carcass condemnation was the most common outcome, representing 84.5% (337/399) of all carcass condemnations, while whole-carcass condemnation accounted for only 15.5% (62/399). Partial carcass condemnations predominated in cattle (87.8%),

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sheep (74.1%), and goats (77.3%). In cattle, lung condemnations were mainly attributed to tuberculosis (6.7%), followed by emphysema (1.9%), pneumonia (1.7%), hydatidosis (1.2%), pleurisy (1.03%), and FMD-related reasons (0.9%). In contrast, the principal causes of lung condemnations in sheep and goats were strongylosis, congestion, emphysema, and pneumonia (Table II; Figure 2).

Organ		Cattle (n = 31,723)		Sheep (n = 48,700)		Goats (n = 59,601)	
		No.	(%)	No.	(%)	No.	(%)
Head	Tuberculosis	226	0.7	-	-	-	-
	Abscess	1	0.003	13	0.03	8	0.01
	Parasitosis	1	0.003	4	0.008	-	-
	FMD	303	0.9	-	-	-	-
Lungs	Tuberculosis	2113	6.6	2	0.004	-	-
	Strongylosis	-	-	2172	4.5	3178	5.3
	Abscess	181	0.6	1660	3.4	1142	1.9
	Congestion	81	0.2	2358	4.8	1964	3.3
	Emphysema	600	1.9	1685	3.5	1120	1.9
	Pneumonia	534	1.7	1434	2.9	2219	3.7
	Pleurisy	327	1.03	914	1.9	572	0.7
	FMD*	303	0.9	-	-	-	-
	Hydatid cyst	394	1.2	211	0.4	95	0.2
	Melanosis	4	0.01	6	0.01	3	0.005
						10293	
Heart	Tuberculosis	2113	6.7	2	0.004	-	-
	Pericarditis	145	0.5	89	0.2	44	0.07
	Myocarditis	10	0.03	4	0.008	2	0.003
	Abscess	5	0.02	15	0.03	3	0.005
Liver	Tuberculosis	417	1.3	-	-	-	-
	Abscess	462	1.5	400	0.8	389	0.6
	Hepatitis	23	0.07	141	0.3	60	0.1
	Fasciolosis	375	1.2	18	0.04	33	0.05
	Hydatid cyst	259	0.8	171	0.3	150	0.2
	Sclerosis	1	0.003	-	-	-	-
Spleen	Tuberculosis	93	0.3	-	-	-	-
	Splenitis	39	0.1	50	0.1	14	0.02
	Congestion	1	0.003	-	-	1	0.001
	Abscess	11	0.03	12	0.02	27	0.04
	Tuberculosis	236	0.7	1	0.002	-	-
	Abscess	2	0.006	-	-	-	-
	Congestion	21	0.07	8	0.02	3	0.005

Table II. Prevalence of pathological conditions by affected organ in cattle, sheep, and goats. *Lungs from animals diagnosed with FMD were condemned in accordance with sanitary regulations rather than because of gross pulmonary lesions.

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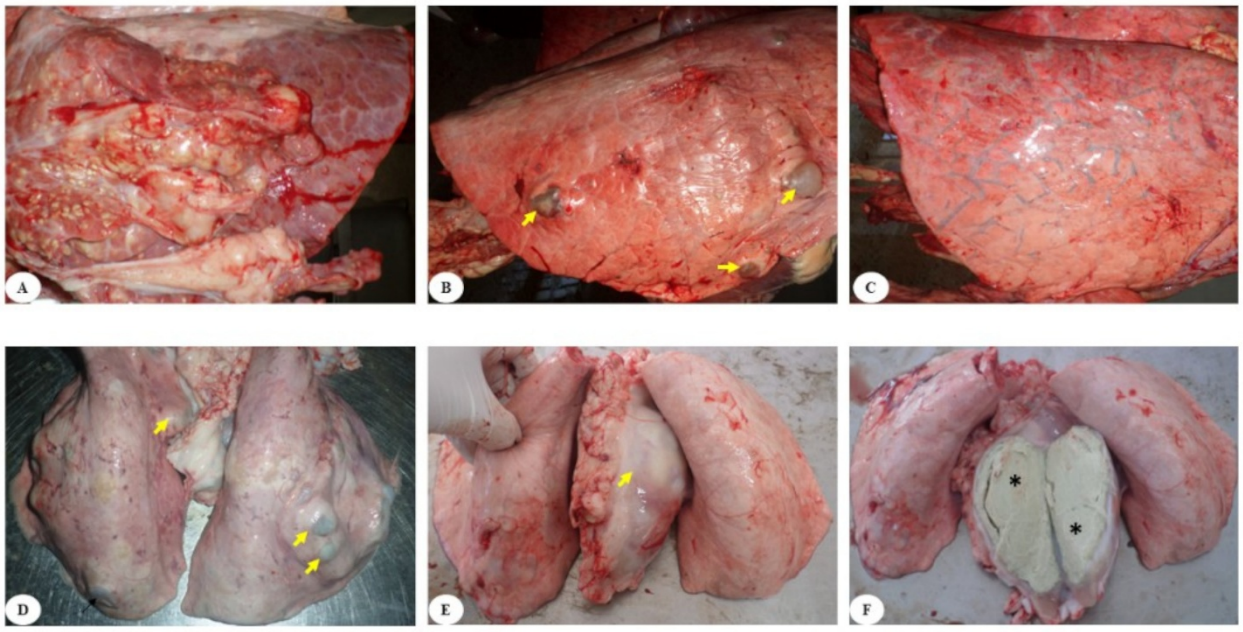

Figure 2. Gross lesions observed in the lungs of cattle and sheep. (A) Multiple caseous nodules of varying sizes in the lungs of a cow. (B) Lateral view of the right lung of a cow showing multiple hydatid cysts (arrows). (C) Interstitial emphysema in the lung of a cow. (D) Lung of a sheep containing multiple hydatid cysts of varying sizes (arrows). (E) Enlarged mediastinal lymph node in a sheep (arrows). (F) Cut surface of an enlarged mediastinal lymph node from a sheep showing a large caseous lesion with concentric lamellae (asterisk), characteristic of caseous lymphadenitis.

Liver condemnations were primarily associated with abscesses, hydatidosis, fasciolosis, and hepatitis across all species. In cattle, tuberculosis (1.3%) was the second most frequent cause of liver condemnation after liver abscesses (Table II and Figure 3). Heart condemnations were mainly caused by tuberculosis in cattle (6.7%), whereas pericarditis was the predominant lesion in sheep (0.2%) and goats (0.07%) (Table II).

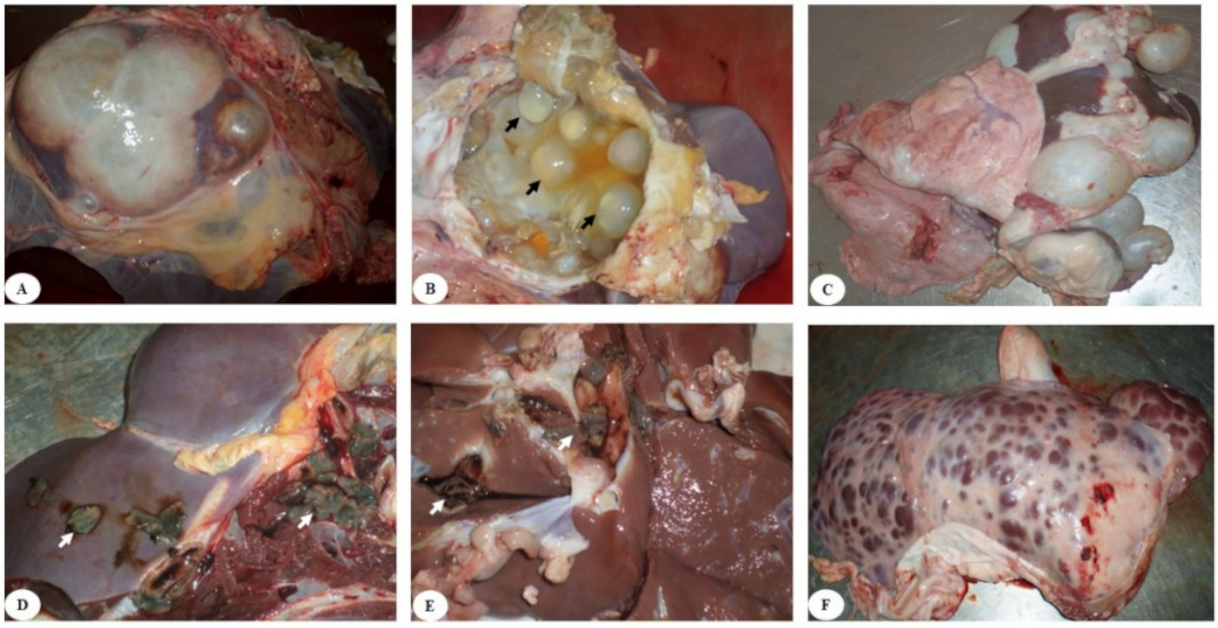

Figure 3. Gross lesions observed in the livers of cattle and sheep. (A) Large, prominent hydatid cyst in the liver of a cow. (B) Excised hydatid cyst containing numerous daughter cysts (arrows). (C) Sheep liver heavily infected with multiple hydatid cysts. (D) Liver of a cow infected with *Fasciola* spp. (E) Sheep liver infected with *Fasciola* spp. (F) Hepatic sclerosis in a cow.

The leading causes of head condemnation in cattle were FMD lesions (0.9%) and tuberculosis (0.7%), whereas abscesses predominated in sheep (0.03%) and goats (0.01%) (TableII). Kidney condemnations were chiefly associated with nephritis and hydronephrosis in all three species (Table II and Figure 4). Similarly, intestinal condemnations were mainly due to tuberculosis in cattle (0.7%) and congestion in sheep (0.02%) and goats (0.005%).

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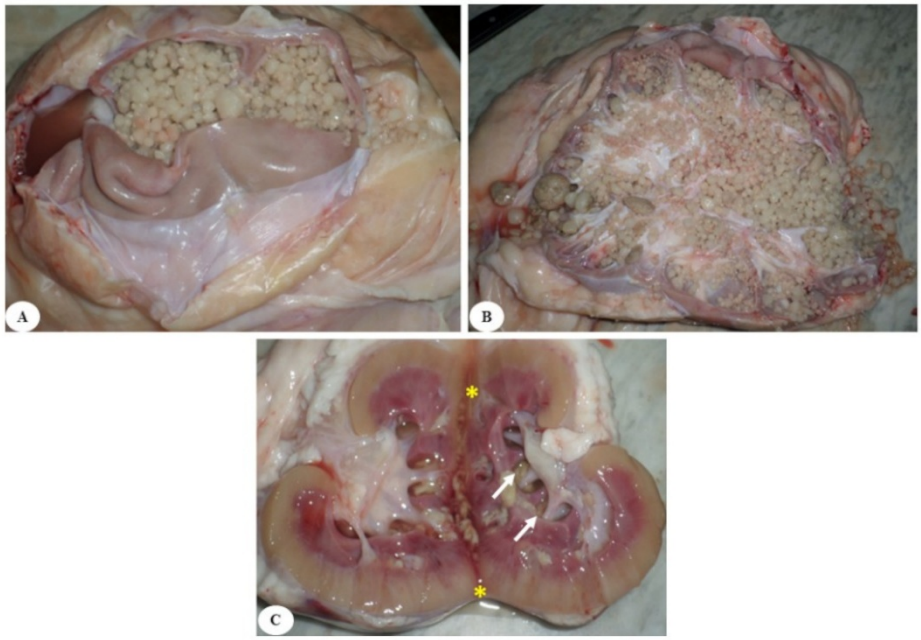

Figure 4. Gross lesions observed in the kidneys of cattle and sheep. (A, B) Cut surfaces of bovine kidneys showing numerous white calculi of varying sizes (nephrolithiasis). (C) A sheep kidney showing dilatation of the renal pelvis containing clear fluid (asterisk) and greenish-brown deposits (arrows), consistent with hydronephrosis.

The principal causes of spleen condemnations were tuberculosis in cattle (0.3%), splenitis in sheep (0.1%), and abscesses in goats (0.04%) (Table II). Orchitis was the predominant cause of genital organ condemnations, with condemnation rates of 0.8%, 0.96%, and 0.6% in cattle, sheep, and goats, respectively (Table II). Whole-carcass condemnation was uncommon across all species. In cattle, 36 carcasses (0.1%) were condemned in their entirety, mainly due to tuberculosis (0.07%), followed by cachexia and jaundice. In sheep, 21 carcasses (0.04%) were condemned in their entirety, with jaundice accounting for the majority of cases, whereas in goats, the five whole-carcass condemnations were mainly associated with jaundice and septicaemia (Table III and Figure 5). Partial carcass condemnation was more frequent, affecting 260 carcasses (0.8%), with tuberculosis accounting for approximately 95% of cases.

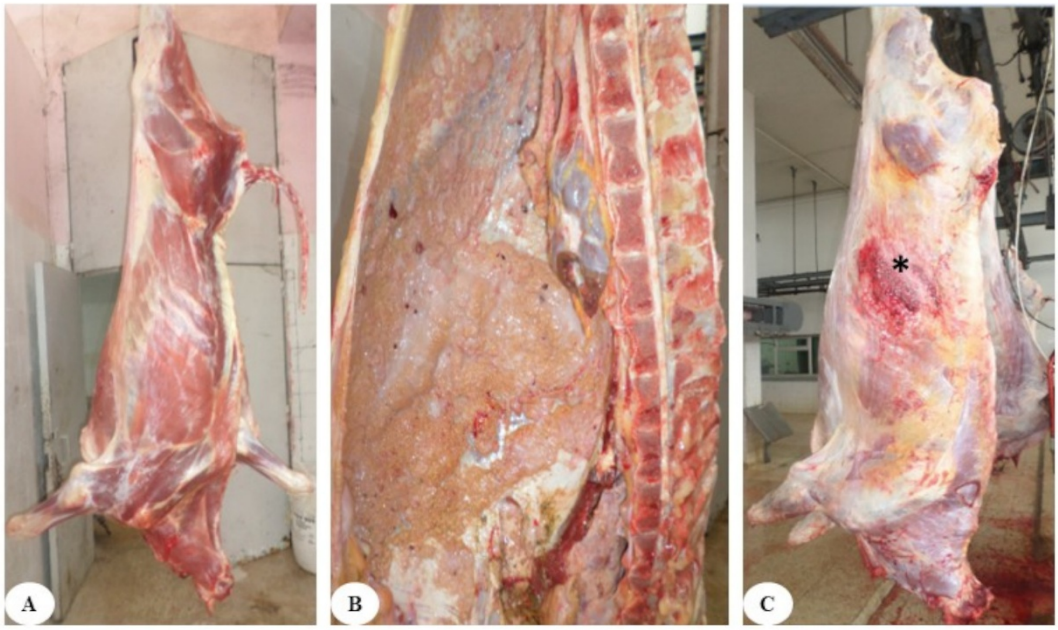

Figure 5. Gross lesions observed in bovine carcasses. (A) Cachectic bovine carcass. (B) Generalised miliary tuberculosis involving the thoracic and peritoneal cavities. (C) Traumatic lesion in a bovine carcass showing serohaemorrhagic infiltration (asterisk).

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Carcass	Pattern of condemned	Cattle (n = 31,723)		Sheep (n = 48,700)		Goats (n = 59,601)	
		No.	(%)	No.	(%)	No.	(%)
Whole carcass	Tuberculosis	23	0.07	-	-	-	-
	Cysticercosis	1	0.003	-	-	-	-
	Jaundice	4	0.01	14	0.03	2	0.003
	Cachexia	5	0.02	1	0.002	1	0.002
	Traumatic lesions	2	0.006	2	0.004	-	-
	Congestion	1	0.003	4	0.008	-	-
	Septicemia	-	-	-	-	2	0.003
Thoracic cavity	Tuberculosis	1	0.003	-	-	-	-
	Pleuritis	2	0.006	3	0.006	-	-
Round	Tuberculosis	17	0.05	-	-	-	-
	Traumatic lesions	11	0.03	1	0.002	-	-
Rib	Tuberculosis	156	0.5	-	-	-	-
	Pleuritis	-	-	56	0.1	17	0.03
Neck	Tuberculosis	19	0.06	-	-	-	-
Fillet		3	0.009	-	-	-	-
Forequarter		11	0.03			-	-
Hindquarter		17	0.05	-	-	-	-
Shoulder		4	0.01	-	-	-	-
Flank		15	0.05	-	-	-	-
½ carcass		4	0.01	-	-	-	-

Table III. Patterns and causes of carcass condemnations in cattle, sheep, and goats slaughtered at the Béjaïa abattoir (2012–2021).

Partial carcass condemnations were considerably more frequent than whole-carcass condemnations. In cattle, tuberculosis was the predominant cause, particularly affecting the ribs, neck, round, flank, and hindquarter. In contrast, partial condemnations in sheep and goats were mainly localised to the ribs and thoracic cavity and were primarily associated with pleuritis (Table III). The direct economic losses associated with organ and carcass condemnations at the Béjaïa abattoir between 2012 and 2021 are presented in TableIV. Overall, cattle accounted for the highest economic losses (USD 518,396.6), followed by sheep (USD 56,297.5) and goats (USD 46,395.8).

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		Lung	Heart	Liver	Spleen	Kidney	Carcass
Cattle	Total condemned weight (Kg)	22685	4546	9222	114.4	366.6	18557.5
	Unit price (DA)	500	1500	2784	1000	1700	1300
	Total (USD)	85 590.8	51 456.4	193 737.2	863,3	4 702.8	182 046.1
Sheep	Total condemned weight (Kg)	10442	88	511	6.2	13.56	602
	Unit price (DZD)	450	2000	3000	1000	1700	1700
	Total (USD)	35 458.04	1 328.1	11 568.1	46.8	173.9	7 722.6
Goats	Total condemned weight (Kg)	10293	39.3	442.4	4.2	1.9	101
	Unit price (DZD)	450	1800	3000	1000	1700	1100
	Total (USD)	34 952.1	534.1	10 015.1	31,7	24.4	838.4

Table IV. Estimated direct economic losses associated with organ and carcass condemnations at the Béjaïa abattoir (2012–2021). *USD: United States dollar; DZD: Algerian dinar; kg: kilogram.

In cattle, liver and carcass condemnations represented the major sources of economic loss, amounting to USD 193,737.2 and USD 182,046.1, respectively, followed by lung condemnations (USD 85,590.8). In sheep, lung condemnations constituted the principal source of economic loss (USD 35,458.04), followed by liver condemnations (USD 11,568.1). A similar pattern was observed in goats, with lung and liver condemnations generating losses of USD 34,952.1 and USD 10,015.1, respectively. In contrast, kidney and spleen condemnations contributed only marginally to the overall economic losses across all species.

Discussion

Abattoir-based surveillance provides valuable information on the occurrence of animal diseases of veterinary and public health importance while enabling the estimation of economic losses associated with organ and carcass condemnations (Pereira et al., 2020; García-Díez et al., 2023). In the present study, approximately one-quarter of slaughtered animals exhibited lesions leading to condemnation, with significantly higher condemnation rates in cattle than in sheep and goats. These findings are consistent with previous reports from Ethiopia and other developing countries, where cattle generally show higher condemnation rates because of their longer lifespan and greater exposure to chronic infectious and parasitic diseases (Mume et al., 2017). The predominance of lung and liver condemnations is consistent with previous reports from Africa (Madzingira et al., 2018; Adebowale et al., 2021; Abdel-Rassol et al., 2022). Their high condemnation rates probably reflect their anatomical and physiological susceptibility to both infectious and parasitic diseases, making these organs particularly likely to be condemned during routine meat inspection (Tembo and Nonga, 2015). Tuberculosis emerged as the leading cause of organ and carcass condemnations in cattle. Pulmonary lesions accounted for the majority of tuberculosis-related condemnations, consistent with the respiratory route being the principal mode of transmission of *Mycobacterium bovis* (Neill et al., 1994; Menzies and Neill, 2000). These findings agree with previous reports from Algeria and other endemic countries (Ahmad et al., 2017; Damene et al., 2020; Gonçalves et al., 2022). Given its zoonotic potential and the evidence of animal-to-human transmission reported in Algeria, strengthening bovine tuberculosis surveillance and control programmes should remain a public health priority. For example, molecular investigations conducted in the same abattoir confirmed the circulation of members of the *Mycobacterium tuberculosis* complex in both cattle and humans, suggesting a potential zoonotic transmission cycle in the region (Damene et al., 2020). In contrast, tuberculosis was rarely detected in sheep and was not observed in goats during the study period. Similarly low prevalence rates have been reported in Ethiopia and Algeria (Asmare et al., 2020; Hamiroune et al., 2020). Although small ruminants are generally considered less susceptible than cattle, their epidemiological role should not be overlooked, particularly in mixed farming systems where interspecies transmission may occur (Marianelli et al., 2010; Muñoz Mendoza et al., 2012). Among non-tuberculous pulmonary lesions, emphysema, pneumonia, pleurisy, and strongylosis represented important causes of lung condemnation. Strongylosis was particularly frequent in sheep and goats, confirming the importance of respiratory parasitism in small-ruminant production systems. Similar observations have been reported in North Africa and Ethiopia, although prevalence varies according to climatic conditions, grazing systems, and parasite control practices (Elati et al., 2017; Tenaw and Jemberu, 2018; Gherroucha et al., 2022). Parasitic diseases also contributed substantially to organ condemnations. Hydatidosis was frequently detected in both lungs and livers, particularly in cattle, confirming the persistence of the *Echinococcus granulosus* transmission cycle in the region. Similar observations have been reported in Algeria, Egypt, Nigeria, and Zimbabwe (Madzingira et al., 2018;

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Adebowale et al., 2021; Abdel-Rassol et al., 2022). Likewise, fasciolosis represented an important cause of liver condemnation, especially in cattle, in agreement with previous Algerian studies (Hamiroune et al., 2020; Hadef et al., 2022). The persistence of these parasitic diseases highlights the need for improved control measures, including regular deworming, proper disposal of infected offal, and control of definitive hosts. Liver abscesses were the leading cause of liver condemnation in all three animal species. This finding is consistent with previous reports from Africa. Liver abscesses are generally associated with chronic ruminal disorders and bacterial infections (Tilahun et al., 2017; Atawalna et al., 2016). In addition to causing condemnation losses, liver abscesses may adversely affect animal productivity and carcass value (McKeith et al., 2012). Although whole-carcass condemnations were uncommon, tuberculosis remained the principal cause in cattle, whereas jaundice predominated in sheep and goats. These findings are consistent with previous studies identifying bovine tuberculosis as one of the leading causes of whole-carcass condemnation in cattle (Phiri, 2006; Sheferaw and Abdu, 2017; Mimoune et al., 2022). The predominance of tuberculosis among condemned bovine carcasses reflects the chronic nature of the disease and the stringent sanitary measures implemented to prevent infected meat from entering the food chain. The estimated direct economic losses exceeded USD 621,000 during the ten-year study period, with cattle accounting for the majority of losses. Liver, lung, and carcass condemnations represented the main sources of economic loss. Similar economic impacts associated with organ and carcass condemnations have been reported in Ghana and other African countries (Atawalna et al., 2016; Abdulai et al., 2025). Because the present estimates only include direct losses, the true economic burden is likely underestimated, as indirect costs related to reduced productivity, treatment, and disease control were not considered. This study has some limitations. As a retrospective abattoir-based investigation, information on age, breed, production system, and geographical origin of animals was unavailable. In addition, meat inspection has limited sensitivity for detecting certain subclinical infections, and the economic analysis included only direct losses associated with condemned organs and carcasses. Therefore, the actual prevalence of certain diseases and their overall economic impact may have been underestimated.

Conclusion

This ten-year retrospective study demonstrates that tuberculosis, hydatidosis, fasciolosis, and liver abscesses remain the principal causes of organ and carcass condemnations in slaughtered ruminants in north-eastern Algeria. In addition to their public health significance, these diseases generate substantial economic losses, particularly in cattle. Strengthening disease prevention, improving farm biosecurity, and reinforcing meat inspection and surveillance systems are essential to reduce condemnations, protect consumers, and enhance the sustainability of the livestock sector.

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Ethical approval

This study did not involve animal experimentation, as it was retrospective. The work was carried out in accordance with the guidelines of the Institutional Committee for the Protection of Animals in Algerian Higher Education and Scientific Research (agreement number 45/DGLPAG/DVA.SDA.14).

Conflict of interest

The authors declare no conflicts of interest.

Author Contributions

Conceptualisation: HD; Methodology: HD, RB, AF; Formal analysis: HD, RB, AF; Investigation: HD, NB; Writing original draft preparation: HD; Writing, review and editing: DT, RB.

All authors have read and agreed to the published version of the manuscript.

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Data availability

The data supporting the findings of this study are available within the article and/or its supplementary materials.

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