

Research Article

Study of major causes and associated economic losses of carcass and organ condemnation in cattle and sheep slaughtered at two abattoirs in the north of Algeria

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Abstract

Inspection at slaughterhouses is an important step for providing a safe meat for human consumption. A cross-sectional study, which involved antemortem and postmortem inspection was conducted from January 2025 to April 2025 to establish condemnation reason in cattle and sheep slaughtered and inspected at two slaughterhouses of Blida, north of Algeria. From a total of 1091 animals (805 sheep and 286 cattle) slaughtered during the period of this survey, 14.78% sheep and 32.51% cattle were condemned. The most dominant condemnation patterns were pneumonia (38.65%), hydatidosis (16.80%), abscess (15.96%) and respiratory strongylosis (15.96%) for sheep and tuberculosis (52.68%), hydatidosis (15.05%), abscess (11.82%), and pneumonia (10.75%) for cattle. Condemnation rate of lungs, hearts, livers, and heads for sheep were 84.87%, 2.52%, 7.56% and 4.20% respectively and for cattle were 91.39%, 49.46%, 26.88%, 1.07% respectively. Also, 4.30% carcasses, 3.22% stomachs and 1.07% udders showed lesions only in cattle. Main causes of lung condemnation was tuberculosis (56.47%), hydatidosis (14.11%), pneumonia (11.76%), abscesses (7.05%), and emphysema (7.05%) for cattle, pneumonia (45.54%), abscesses (18.81%), hydatidosis (13.86%), hemorrhagic lung (7.92%), and emphysema (5.94%) for sheep. Liver was condemned mainly due to abscess (36%), hydatidosis (32%) and tuberculosis (24%) for cattle, hydatidosis (55.55%), hepatitis (33.33%) and abscesses (11.11%) for sheep. For the hearts, tuberculosis (97.82% for cattle and 66.66% for sheep) was the major cause of condemnations. These condemnations have generated economic losses with almost 4 077000.00 DZD. Further studies will be important for designing control strategy for prevention and eradication of the diseases.

Keywords

Abattoir, cattle, food safety, condemnation, sheep.

List of Abbreviations

°C : degree Celsius

mm : millimeter

FAO : Food and Agriculture Organization

DZD : Algerian dinars

Cis : Confidence intervals

VNSD : Viral nodular skin disease

TRP : Traumatic reticuloperitonitis

Introduction

Meat has high nutritional value, being rich in high-quality proteins and other nutrients as minerals [1]. Ensuring healthy meat without abnormalities is very important for public health [2]. Abattoirs play an important role, in surveillance of various diseases of human and animal health importance [3]. The collection of sanitary information at slaughterhouse level contributes to improving knowledge of the national epidemiological situation [4]. At abattoir, organs and carcasses were condemned due to various pathogens and /or pathological conditions [5]. The main causes of organ condemnation during post mortem inspection are diseases originated by parasites, bacteria and viruses [6]. Some of the pathogens are zoonotic and have public health significance ; and all causes of condemnation incur serious economic losses to the livestock industry [5].

Many surveys were carried out at the slaughterhouse level to determine the prevalence and to collect information on reasons for meat and offal condemnation [7, 8]. The prevalence rates vary from 0.02% [9] to 87.7% [1] and the data about the main causes of carcass and organ condemnation in different countries varies significantly [10, 11].

In the Blida region, the livestock farming is focused on cattle production and sheep fattening. Also, the consumption of red meat has increased with the growth of the local population. The number of cattle slaughtered in this region has increased from 6,762 in 2021 to 27,752 in 2024,

while the number of sheep slaughtered has been estimated at 106,260 in 2024 [12]. Currently, there is a lack of information on occurrence of various diseases/causes and their economic losses due to organ and carcass condemnation in the north of Algeria specially the Blida region. Although similar surveys have been conducted in other regions [13, 14], it is important to carry out the study because the prevalence and incidence of diseases differ according to geographical areas. Thus, the aim of the present survey was to determine the causes of organ and carcass condemnations in cattle and sheep carcasses based on post-mortem inspection procedure and to evaluate the economic losses that occur at Blida region.

Results

1. Number and percentage of condemnations in the slaughtered animals

A total of 212 animals were seized for various reasons, representing a prevalence of animals with at least one condemned organ/carcass of around 19.43% (95%CI: 17.1% - 21.8%). Condemnations were higher ($p < 0.00001$) in cattle than in sheep (Table 1).

Table 1. Number and percentage of condemnations in the slaughtered animals.

	Animals	Condemnations n (%)	95% CI
Sheep	805	119 (14.78)	[12.3% - 17.2%]
Cattle	286	93 (32.51)	[27.1% - 37.9%]

95% CI (%): 95% confidence interval

2. Number and percentage of condemnations according to the sex and age of animals

For cattle, females were slightly more affected than males and the rate of condemnation in adult animals was significantly greater than young's. While for sheep, the rejection rate was significantly higher in males and young animals ages less than 1 year (Table 2).

Table 2. Number and percentage of condemnations of animal slaughtered based on sex and age of animals.

Cattle				Sheep			
Category	N	%	p-value	Category	N	%	p-value
Sex							
Male	41	44.08	0.25	Male	110	92.43	<0.0001
Female	52	55.91		Female	9	7.56	
Age							
< 2ans	28	30.10		[6 mois -1an]	93	78.15	
≥2 ans	65	69.89	<0.001	]1an- 5 ans[	16	13.44	<0.001
				> 5ans	10	8.40	

3. Causes for condemnations in slaughtered cattle and sheep

Our results showed that various abnormalities and diseases (Table 3, Figure 1) were encountered during the postmortem examination including :

- Respiratory lesions : pneumonia (Figure 2), emphysema (Figure 2), hemorrhagic lung (Figure 2), hepatitis, hepatization of lung.
- Parasitic lesions : hydatidosis (Figure 4), respiratory strongylosis, sarcoptic mange.
- Bacterial diseases : tuberculosis (Figure 3), actinobacillosis, actinomycosis.
- Viral diseases : viral nodular skin disease (VNSD).
- Traumatic lesions : traumatic reticuloperitonitis (TRP), traumatic carcasses.
- Other lesions : abscess (Figure 2), rotten and hemorrhagic carcasses.

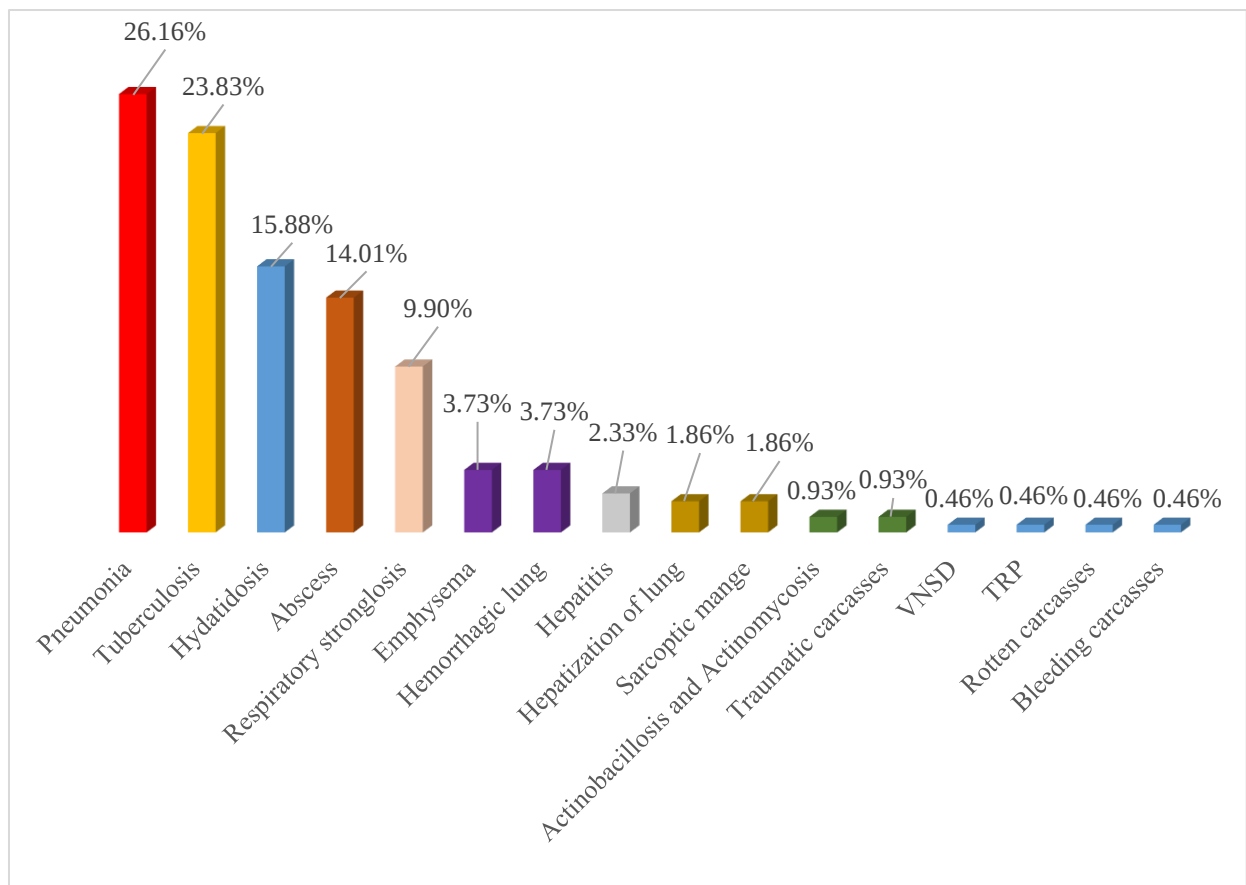


Figure 1. Causes for condemnations in slaughtered animals.

Table 3. Number and prevalence of causes for condemnations in slaughtered cattle and sheep.

Causes for condemnations	Bovins		Ovins	
	n/93	%	n/119	%
Pneumonia	10	10.75	46	38.65
Tuberculosis	49	52.68	2	1.68
Hydatidosis	14	15.05	20	16.80
Abscess	11	11.82	19	15.96
Respiratory strongylosis	2	2.15	19	15.96
Emphysema	6	6.45	2	1.68
Hemorrhagic lung	0		8	6.72
Hepatitis	1	1.07	4	3.36
Hepatization of lung	0		4	3.36
Sarcoptic mange	0		4	3.36

Actinobacillosis and Actinomycosis	1	1.07	1	0.84
Traumatic carcasses	2	2.15	0	
Viral nodular skin disease (VNSD)	1	1.07	0	
Traumatic reticuloperitonitis (TRP)	1	1.07	0	
Rotten carcasses	1	1.07	0	
Bleeding carcasses	1	1.07	0	
p-value		<0.0001		<0.0001

4. Study of seized meat and offal

The total number of condemned organs/carcasses from both animal species was 283, condemnations were significantly greater ($p=0.005$) in cattle 165 (58.30%) than sheep 118 (41.69%). Of the 212 sheep and cattle seized, the lungs ($n=186$) was the most affected organ, followed by the hearts ($n=49$), the livers ($n=34$), the heads ($n=6$), the stomachs ($n=3$) and udders ($n=1$) (Figure 5).

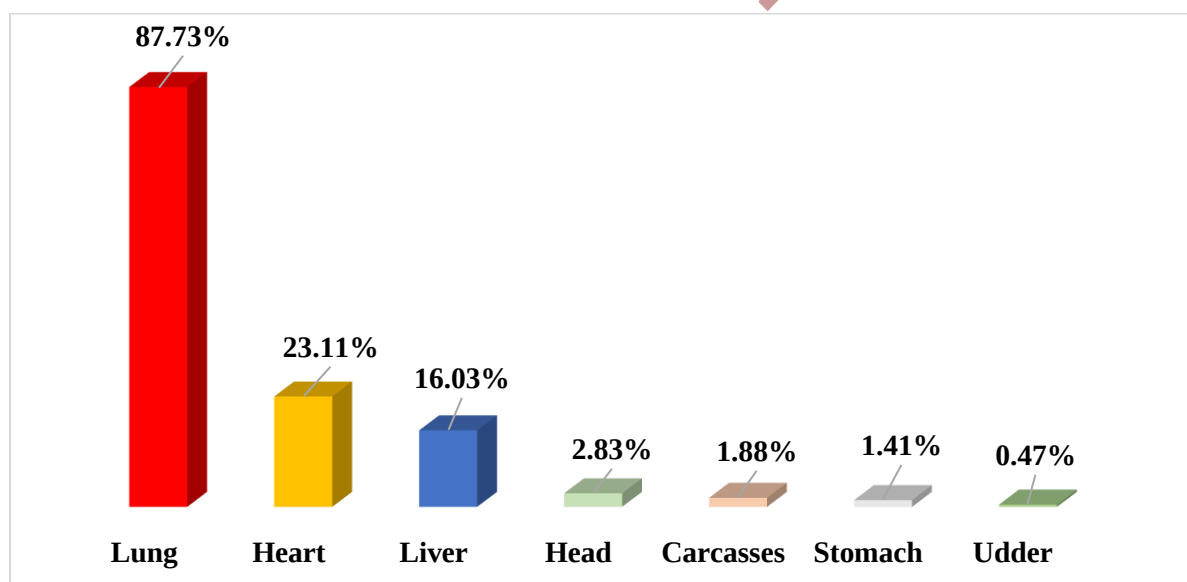


Figure 5. Meat and organs seized from both animal species

The lung was the most seized organ in both animal species; the heart and the liver were more commonly rejected in cattle than in sheep, while the carcass, the stomach, and the udder were

only seized in cattle. For the heads, the rejection were more recorded in sheep than cattle (Table 4).

Table 4. Comparison of the meat and organs seized among condemned animals.

Seized meat and offal	Bovins		Ovins		p-value
	n/93	%	n /119	%	
Carcasses	4	4.30	0		0.13
Lung	85	91.39	101	84.87	0.24
Heart	46	49.46	3	2.52	<0.0001
Liver	25	26.88	9	7.56	0.006
Head	1	1.07	5	4.20	0.22
Stomach	3	3.22	0		0.24
Udder	1	1.07	0		/

The lung was seized for various reasons. In cattle, the main cause for lung condemnation is tuberculosis and the least reason is TRP. In sheep, pneumonia was the most pathology recorded, while lower condemnation rates were recorded for tuberculosis and strongylosis (Table 5).

In the case of liver condemnation, abscess for cattle and hydatidosis for sheep take the highest portions, whereas RTP and abscess showed the lowest levels for both cattle and sheep respectively (Table 6).

Of the hearts that were condemned, tuberculosis was the most frequently encountered reason for both animal species (Table 7).

For the head, four cases for sarcoptic mange, and one case for actinobacillosis were recorded in sheep. While in cattle, only one case of actinomycosis was found. The other organs were seized in cattle for tuberculosis, these are 3 cases for the stomach and a single case for the udders. The four cases of carcasses condemnation were recorded for the following reasons :

- 1st case : tuberculosis+ traumatic carcasses,
- 2nd case : abscess + traumatic carcasses,
- 3rd case : bleeding carcasses + VNSD,
- 4th case : rotten carcasses.

Table 5. The prevalence of causes for lung condemnation.

Cattle (N=85)			Sheep (N=101)		
Causes for condemnations	n (%)	p-value	Causes for condemnations	n (%)	p-value
Tuberculosis	48 (56.47)	<0.0001	Pneumonia	46 (45.54)	<0.0001
Hydatidosis	12 (14.11)		Abscess	19 (18.81)	
Pneumonia	10 (11.76)		Hydatidosis	14 (13.86)	
Abscess	6 (7.05)		Hemorrhagic lung	8 (7.92)	
Emphysema	6 (7.05)		Emphysema	6 (5.94)	
Respiratory strongylosis	2 (2.35)		Hepatization of lung	4 (3.96)	
TRP	1 (1.17)		Tuberculosis	2 (1.98)	
			Respiratory strongylosis	2 (1.98)	

Table 6. The prevalence of causes for liver condemnation.

Cattle (N=25)			Sheep (N=9)		
Causes for condemnations	n (%)	p-value	Causes for condemnations	n (%)	p-value
Abscess	9 (36)	0.020	Hydatidosis	5 (55.55)	0.26
Hydatidosis	8 (32)		Hepatitis	3 (33.33)	
Tuberculosis	6 (24)		Abscess	1 (11.11)	
Hepatitis	1 (4)				
TRP	1 (4)				

Table 7. The prevalence of causes for heart condemnation.

Cattle (N=46)			Sheep (N=3)		
Causes for condemnations	n (%)	p-value	Causes for condemnations	n (%)	p-value
Tuberculosis	45 (97.82)	<0.0001	Tuberculosis	2 (66.66)	-
TRP	1 (2.17)		Emphysema	1 (33.33)	

5. The partial and total organs and carcasses condemnations.

Of the 283 organs and carcasses seized, there was 162 (57.24%) cases of total condemnation, and 121 cases (42.75%) of partial condemnation. The type of condemnations of different organs and carcasses are shown in figure 6.

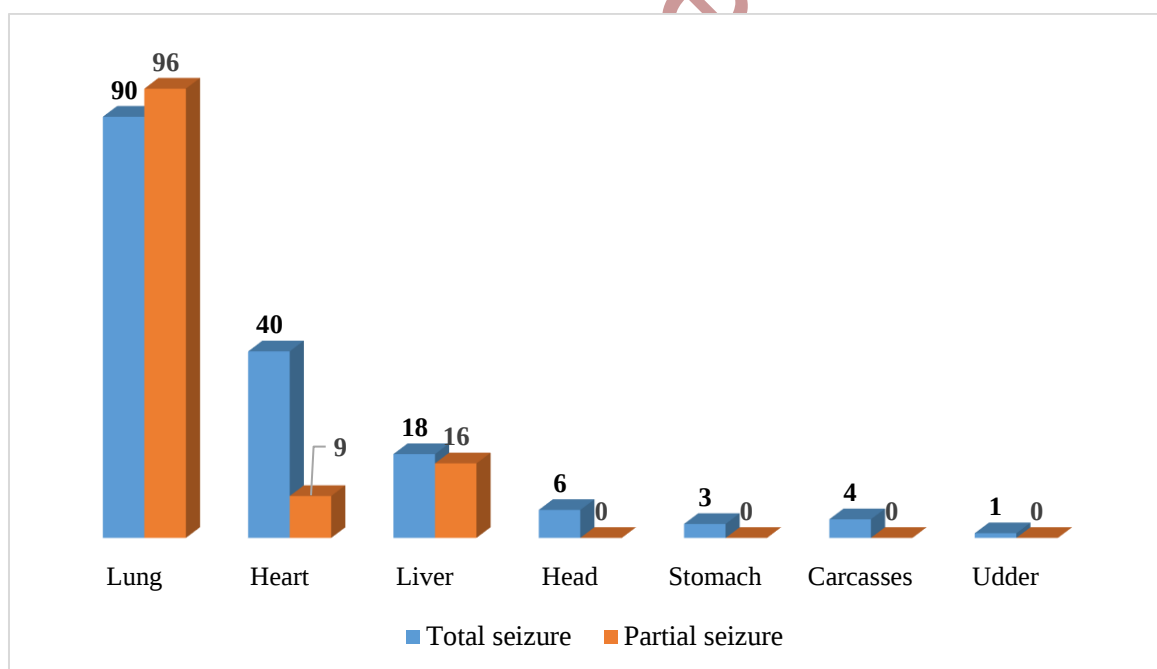


Figure 6. Number of partial and total organs and carcasses condemnations.

6. Estimation of financial losses of organs and carcasses

For the economic loss, it was estimated according to the weights of seized organs and carcass, considering the selling price per kg of meat on Blida region. Out of 1091 cattle and sheep carcasses inspected, 1200kg of carcasses and 485kg of organs were seized. Therefore, the total economic loss of both organs and carcasses was estimated at 4 077000.00 DZD as shown in Table 8.

Table 8. Partial and total condemnations and estimation of economic losses.

Offal and Meat condemned	Average weight (kg)	Unit price in DZD	Global loss in DZD
Carcasses	1200	2500.00	3 000 000.00
Lung	215	2400.00	516 000.00
Heart	30	3000.00	90 000.00
Liver	80	5000.00	400 000.00
Head	150	400.00	60 000.00
Stomach	5	2000.00	10 000.00
Udder	5	200.00	1 000.00
Total			4 077000.00

Disussion

Many surveys conducted to investigate conditions and abnormalities have been performed in different countries abattoir [10] and different condemnation rates of carcasses were obtained from : Namibia, from cattle 0.37% of carcass condemnations found by Mbiri et al. [8], Iran, the rates of carcass and offal condemnations were 0.21% of cattle and camels and 0.02% of the sheep and goats [9], Zambia, 0.55% cattle carcass and offal condemnations [7], Turkey, 0.32% carcasses and 2.33% offals for both sheeps and cattle [15], USA, 2.01% cattle carcass condemnations [16], Benin, 12.17% cattle carcass condemnations [17], Italy, 2.77% sheep and 23.87% cattle of both carcass and organ condemnations [18], Ethiopia, from cattle, a rate of 39.06% of organ condemnations was obtained by Ahmed et al. [2] and 69.2% of organ and carcass condemnations by Sheferaw and Abdu [5], Algeria, 46.20% of sheep organ and

carcass condemnations [4] and Egypte, 8.7% sheep and 87.7% cattle of both meat and offal condemnations [1]. This difference in the results obtained can be explained by several factors such as experimental design, geographical location, inspection technique and season and year of study [8,10]. Our results revealed that parasites represented the most frequently encountered causes for condemnation of organs, particularly in sheep which agree with other research works [2, 5, 9, 13, 14, 18, 19, 20]. This means that parasites are responsible for considerable losses of meat, and especially offal, in sheep, more so than other diseases [11]. This could be mainly caused by the presence of stray dogs and cats which can excrete parasites and contaminate plants and food intended for livestock [11]. Stray dogs are frequently involved in environmentally transmitted diseases, particularly soil- and water-borne parasites, due to uncontrolled defecation and opportunistic behavior [21].

Our results showed that sheep were more infested with parasites than cattle; this can be explained by the fact that sheep are raised in groups in extensive farms in close and constant contact with stray dogs and cats [10, 22]. In our study, the most frequent reason for condemnation for cattle was tuberculosis 52.68%, indicating active circulation of *Mycobacterium bovis* in algerian herds, particularly in old animals. This high prevalence is explained by airborne transmission between animals, overcrowding of animals, the prolonged persistence of the bacillus in the environment, as well as by gaps in screening and eradication strategies [23]. *M. bovis* infections account for a high amount of granulomatous lesions detected in Algerian slaughter cattle during standard meat inspection at Algiers and Blida abattoir [24]. Indeed, **Sahraoui et al. [24]** found that from gross visible granulomatous lesions isolated from 100 cattle in the abattoirs of Algiers and Blida, *M. bovis* was isolated from 88 animals. The economic importance and public health significance of this zoonotic disease have been established in many countries [17]. Indeed, some authors found that tuberculosis was the principal causes for condemnation [5, 7, 13, 17]. The third causes for condemnation for the both animal species was abscess. This corroborates with observations made by many authors [4, 7, 19, 20]. Infection by some germs such as *Corynebacterium pseudotuberculosis*, *Staphylococcus aureus*, *Streptococcus* spp was sometimes the cause of the formation of abscesses, these germs can be transmitted by breeding equipment to animals [25]. Pneumonia have also been recorded in our study, some authors have previously reported similar results [2, 4, 14, 16, 19, 20]. Others respiratory pathologies (emphysema, hemorrhagic lung, hepatization) were also observed in the present study. The interlobular structural organization of the lungs in ruminants (lack of collateral ventilation...), especially cattle, makes these animals more susceptible to respiratory

diseases [26]. Other factors such as poor ventilation in the sheepfolds, overcrowding in the livestock building, exhaustion during the dry season due to long treks in search of pasture and water, climate change, exposure to dust and parasitism can play a role in the emergence of these respiratory diseases [4, 19, 26]. Because of these factors, lungs are may be the most condemned organ in the abattoirs [25]. This is observed in the present study and corroborates with various investigations in different countries [4, 9, 17, 25, 27]. In another hand others investigations [2, 5, 19, 20] found that the liver was the most seized organ. According to **Grist [28]**, the liver and lung were highly infested and more susceptible than other organs because they are richly vascularized and act as a filter organ, which may be a preferential location for germs. Our results showed that the lung is most frequently seized for bovine tuberculosis, which was observed by **García-Díez et al. [10]**. According to **García-Díez J.**, the thoracic cavity is known to be the main location of bovine tuberculosis lesions [10]. Similarly, inflammation of lung tissue and certain parasitic pathologies such as hydatidosis have also been considered as the most frequently encountered causes of lung condemnation [5, 10, 19, 20, 27]. Hydatidosis, the major parasitosis found in the present survey, was reported to be the principal pattern of liver condemnation [19]. Condemnation for hepatitis and abscesses is expected because parasitic infestation can cause degeneration of liver tissue [10]. The heart condemnation was mainly associated with tuberculosis and emphysema, while a very low percentage for TRP was found. **García-Díez et al. [10]** reported that the heart damage was usually secondary to respiratory problems. The economic losses incurred in abattoir survey were 4 077000.00 DZD, equivalent to US Dollar 31385.68, which was higher than the losses reported earlier [8, 20, 26]. These differences between studies may be due to study plan, slaughterhouse output, price of meat and offal among countries, prevalence of different pathologies, rejection rate of organs [19, 20], currency conversion and year of estimation. However, no matter how significant these losses are, they always have a negative effect on meat production, abattoir income and the economy in general [8].

The importance of the current study reveals that it is among the very rare abattoir survey study in the north of Algeria specially the region on Blida. However, there are some restrictions like the short sampling period to show long-term trends and the rare events or pathogen spikes might be missed. Geographical restriction to two abattoirs so the practices, hygiene, and animal sources at two plants do not represent the whole country or region because each region may have distinct farming or processing conditions. Possible seasonal variation because this study is done in only one season which can missed high or low risk periods in other months also, the

weather and temperature change across the year which can affect microbial growth and animal health, and finally, the representativeness of the studied population so sampled animals may not match the wider livestock population. Other studies must be carried out to determine the true prevalence of the causes of slaughterhouse condemnations of organs and/or carcasses in different regions of Algeria.

Materials and Methods

Study area

This study was carried out over a period ranging from January to April 2025 in two slaughterhouses (Zaouia et Boufarik) located in the region of Blida in the north of Algeria. Blida city is situated about 45 km south-west of the capital Algiers. Blida lies with 190 metres above the sea and is characterized by a Mediterranean climate. The average annual temperature is 17.9 °C and the annual rain fall is 791 mm. The study area broadly fall within agricultural zone with significant production, farm animals are also diversified (cattle, sheep and goats).

Study population

A total of 1091 animals (805 sheep and 286 cattle) slaughtered for local consumption were randomly selected (we select every 5th cattle and every 10th sheep) the study and identified by age and sexe during ante mortem inspection. Cattles were classified into two groups : < 2 years and ≥ 2 years, while sheep were classified into three groups : [6 months -1year],]1year- 5 years[, ≥ 5 years. The animals' ages were provided by the breeders and then estimated, where possible, by examining the animals' teeth. The breeds of cattle were local and cross. Slaughter animals were transported to the abattoirs by road on approved transport vehicles and they were brought for slaughter from different districts around Blida region.

Study design and data collection

A cross-sectional survey was conducted to determine the causes of condemnation in cattle and sheep and to estimate economic loss. In this study each week four days visit was made for the examination of slaughtered animals which correspond to the days of highest slaughter. The animals were selected by systematic random sampling techniques and on each visit day, about 50 to 55 sheep and 17 to 18 cattle were examined and ; accordingly, a total of 805 sheep and 286 cattle were examined. The study was conducted using previously designed questionnaires. The questionnaire collects and provides information on the slaughtered animals (age, sex,

species), the type of lesion, the organ affected, and the weight of the different organs condemned by the inspector.

Table 9. The diagnostic criteria used for identifying pathological conditions.

Pathological conditions	Diagnostic of specific criteria
Tuberculosis	-Visual and palpation of yellowish-white, encapsulated granulomas with caseous or gritty calcified centers in target organs like lungs and associated lymph nodes (bronchial and mediastinal) as well as retropharyngeal and mesenteric nodes.
Pneumonia	-Visual and palpation of areas of dark red or grey consolidation (firm, heavy, un-collapsed lung tissue), often in the cranioventral lobes or fibrinous pleurisy adhesions on the lung surface. - In the airways: Presence of catarrhal, purulent, or bloody exudate inside opened bronchi and the trachea.
Hydatidosis	-Visual and palpation of fluid-filled vesicular cysts of varying sizes embedded in the tissue or bulging on the organ surface predominantly found in the lungs and liver. -Cut Surface: A distinct external white germinal/laminated wall with clear hydatid fluid and sometimes gritty brood capsules inside.
Respiratory strongylosis	-Visual and palpation of small nodular, subpleural gritty foci (<i>Mullerius</i>) or generalized rubbery worm-filled large bronchi (<i>Dictyocaulus</i>). -In the airways: Slicing major bronchi and the trachea reveals slender, thread-like white adult nematodes mixed with mucus or focal chronic bronchitis.
Emphysema	-Visual appearance: Pale pink to grayish-yellow, overinflated, bulbous lung lobes with visible subpleural air bubbles or pearl-like bullae. -Palpation: Puffy texture with a characteristic spongy or crepitant feel.
Hemorrhagic lung	-Visual appearance: Focal, multifocal, or diffuse dark-red to black patches on the pleural surface and deep parenchyma. -Palpation: Firm or spongy areas that ooze dark, unclotted or partially clotted blood upon incision.

Hepatitis	-Visual appearance: Alterations in normal reddish-brown color (pale, yellow-brown, or bright red), swelling, and presence of white/gray foci, fibrous scars, or migratory parasitic tracts. -Palpation and Incision: Increased organ consistency (firmness), rounded borders, and gritty or caseous textures upon cutting into portal lymph nodes or hepatic parenchyma.
Hepaticization of lung	-Visual appearance: Lungs resemble liver tissue (heavy, solid, and airless). Divided into red hepaticization (dark red, hyperemic, firm) and gray hepaticization (grayish or pale yellow, dry, highly dense) stages typical of fibrinous or bacterial pneumonia. Palpation and Incision: Firm, heavy, and non-crepitant consistency; sinking in water. Cut surfaces display a dry, granular appearance without bubbling air.
Sarcoptic mange	-Thickened, wrinkled, and hyperkeratotic skin with crusts, papules, and large folds, predominantly starting around the head, neck, and shoulders.
Actinobacillosis	Firm, hard, nodular granulomatous swellings and abscesses containing thick, sticky, grayish-white or greenish-yellow pus. Primarily affects soft tissues, especially the tongue, lips, and associated head lymph nodes (infrequent in sheep)
Actinomycosis	Gritty pus or tissue scrapings show characteristic hard sulfur granules Involves hard bony tissues, characteristically the mandible or maxilla of cattle.
Traumatic carcasses	Visual assessment of asymmetrical tissue damage, hemorrhage in musculature, fractured bones, and torn or lacerated soft tissues.
Viral Nodular Skin Disease	Subcutaneous nodules clearly visible after skinning; characteristic nodules and ulcers found across the mucous membranes of the digestive tract, trachea, and lungs.
Traumatic Reticulo-peritonitis	-Presence of metallic or sharp foreign objects (nails, wire) piercing the reticular wall. -Localized peritonitis, fibrinous or purulent adhesions between the reticulum, diaphragm, and adjacent organs (liver or spleen).
Rotten carcasses	-Abnormal, foul, putrid, or sour odors emanating from the meat, body cavities, and musculature. -Discoloration of the flesh (greening, darkening, or hyperemic blood pooling), loss of muscle tone, and gas accumulation or bloating in uneviscerated parts.

Bleeding carcasses	-Check if subcutaneous, axillary, and intercostal blood vessels are full of blood and congested. -Look for dark, dull, or wet meat appearance instead of a bright, well-set, dry surface.
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Methods of inspection (examination)

Routine examination was carried out by the qualified veterinary hygiene inspector assistants. Decisions are made to confirm or cancel the slaughter of the animals. The technical methods used to achieve reliable results followed the logic below :

Antemortem inspection

Before slaughter, each animal was examined for its general condition, nutritional status and for the presence of any abnormality or clinical sign. This inspection is carried out according to the following steps:

- Presentation of a slaughter authorization certificate is mandatory for any animal entering the slaughterhouse. This document allows the health officer to distinguish between sanitary and ordinary slaughter, with verification of the animal's identification and ear tag number, if present ;
- An initial remote examination allows the health officer to identify certain pathologies ;
- If necessary, the veterinarian performs a detailed clinical examination on certain animals.

Decisions were taken according to the actions specified by FAO [22]. Sick or infected animals, as well as the overworked were isolated in a lazaret, while, healthy animals were passed for slaughter.

Postmortem inspection

This inspection was conducted approximately one hour after slaughter and it was carried out according to the following steps:

- a A general inspection : to get a first impression of the animal's health after slaughter.
- b Inspection of the viscera and organs: to detect any internal abnormalities in appearance, shape, color, consistency of all organs, especially the liver, lung, heart, kidneys. The examination of

the viscera follows a systematic procedure, as indicated in the table 10. Pathological lesions were differentiated and the following judgment was done :

-Accepted for human consumption :Meat and organs show no disease or contamination and are safe for people.

-Partial Condemnation: Only a small, localized part or single organ is removed, while the healthy rest is kept.

-Total Condemnation: The whole carcass and all organs are destroyed due to widespread disease or toxic risks. [29].

Table 10. Visceral inspection technique [30].

Organ/System	Steps of examination
Heart and pericardium	-Visual examination of the pericardial sac (parietal pericardium); -Visual observation and palpation of the heart; -Incision of the pericardium and observation of the fluid; -Longitudinal incision to open the ventricles and penetrate the interventricular septum
Lungs, trachea, esophagus	- Visual examination of the lungs: appearance, volume, color, etc.; - Palpation of all lobes, from the hilum to the periphery; - Incision and examination of the tracheobronchial, mediastinal, and apical lymph nodes; - Incision of the trachea and bronchi and of each lung to examine the parenchyma; - Visual examination and palpation of the esophagus.
Liver	- Visual examination ; - Palpation of both surfaces ; - Palpation and incision of the hepatic lymph nodes ; - Two incisions on the visceral surface : • Long and shallow (between the right and left lobes) ; • Short and deep (caudate lobe).

Spleen	- Visual examination and palpation ; - Incision if necessary.
Kidney	- Visual examination and palpation ; - Incision along a sagittal plane ; - Incision and examination of the renal lymph nodes.
Digestive tract	- Visual examination : rumen-reticulum junction, mesentery, omentum, intestinal wall ; - Palpation, incision if necessary of the gastric and mesenteric lymph nodes.
Uro-genital tract	- Visual examination of the genital organs and uterine contents; - Palpation and incision if necessary (without contaminating the carcass); - Incision of the scrotal nodes (male).
Head, tongue	- Visual examination of the external surfaces of the head ; - Incision of the mandibular (submandibular), parotid, and lateral and medial retropharyngeal lymph nodes. - Visual examination and dorsoventral palpation of the tongue.

Estimation of economic loss attributed to organ and/or carcass condemnations

The estimation of economic losses was calculated according to the weight of organs and meat seized and measured directly in kilograms and their average local unit (per kg) prices during the study period which was provided by local markets in the study region. In fact, at the time of our survey the price of the liver, lung, heart, beef is 5000 DZD, 2400 DZD, 3000 DZD and 2500 DZD respectively. A rate of 1USD to 129.9 DZD was used to convert the total financial losses to US dollars.

The total economic loss encountered during this study is computed by using the following:

Total loss = (C * PC) + (Lu * PLu) + (H * PH) + (L * PL) + (He * PHe) + (S * PS) + (U * PU). Where in kg, C = Carcasses average weight condemned, Lu = lung average weight condemned, H = heart average weight condemned, L = liver average weight condemned, He =

Head average weight condemned, S=Stomach average weight condemned, U = Udder average weight condemned. Where in DZD, PC = Unit price of carcasses, PLu = Price of lung, PH=Price of heart, PL = Price of liver, PHe = Price of head, PS=Price of stomach, PU =Price of udder.

Statistical analysis

For statistical analysis, we used the software program Microsoft Excel 2010 and IBM SPSS Statistics Version 20 © IBM Copyright, IBM Corporation and its licensors 1989.2011 IBM., USA. The collected data were analyzed according to animal species (cattle and sheep), gender, age, and other relevant factors based on the number and percentage of animals slaughtered and recorded in the slaughterhouses. Confidence intervals (CIs) at a 95% confidence level were calculated. The Chi-square test of homogeneity was applied to compare the different factors studied. Statistical significance was set at $p \leq 0.05$.

Authors' Contributions:

A.D Concept and design of the study, recording data, drafting of the manuscript, data analysis, interpretation of the results, and prepared the final draft of the manuscript,. S.Z performed the statistical analysis, revising the manuscript and final approval of the paper following critical editing. All authors read and approved the final manuscript for publication.

Acknowledgements:

We would like to thank the veterinary inspectors of the two slaughterhouses, for their availability and their invaluable support during our survey.

Competing Interests:

The authors declare that there is no conflict of interest.

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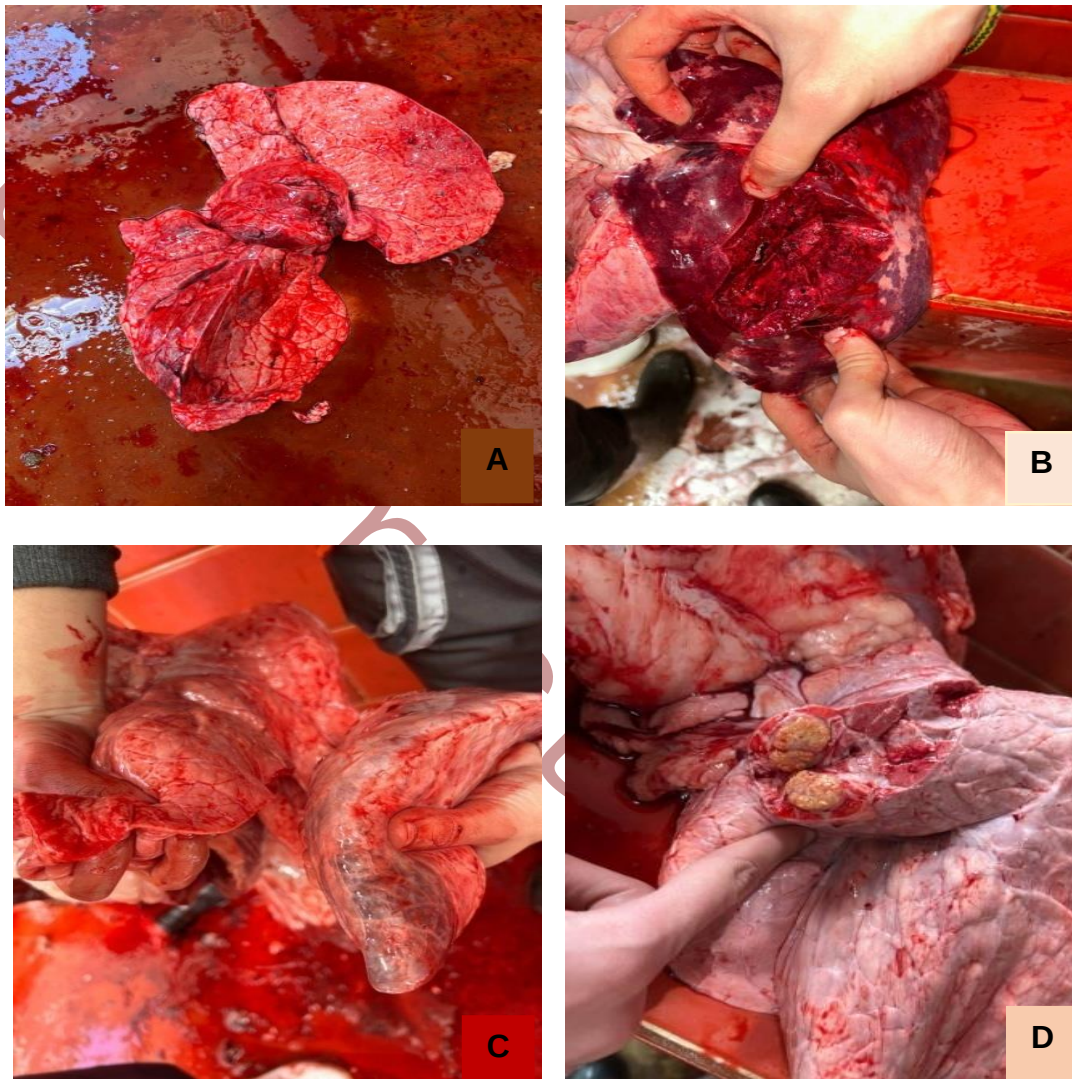
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Figure legends



Figures 2. Main pulmonary lesions encountered in the two animal species.

(A) ; Pneumonia, (B); Hemorrhagic lung, (C); Emphysema, (D); Abscess in the lung.

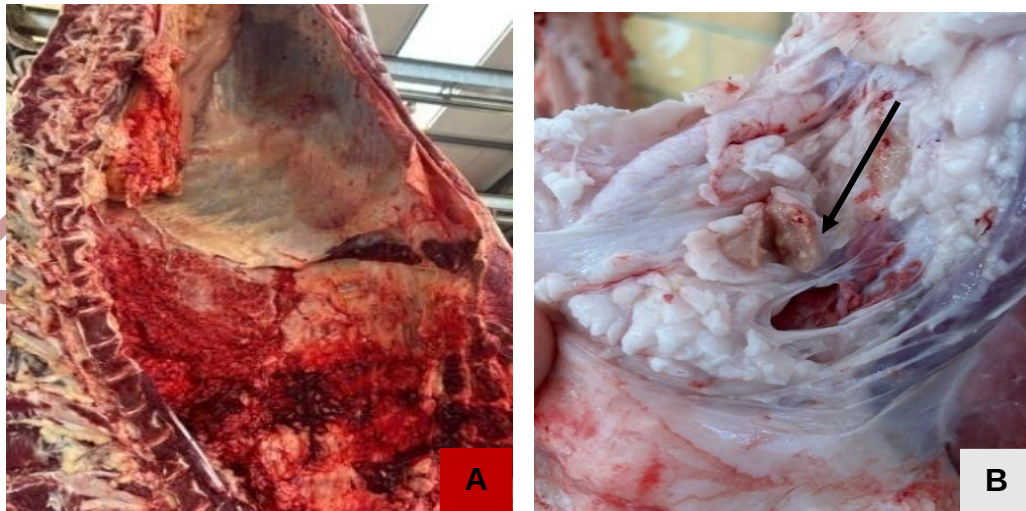


Figure 3. Tuberculosis lesion.

(A); Tuberculosis in bovin carcass, (B); Tuberculous lymph node (black arrow).



Figure 4. Hydatid cyst in the liver.

(A); Dead and calcified cyst (B) Living cyst.