

# LUNG LESIONS ON CAMELS (*Camelus dromedarius*) SLAUGHTERED IN TAMBOUL ABATTOIR, SUDAN: PATHOLOGICAL AND HAEMATOLOGICAL STUDY

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## ABSTRACT

This investigation was carried out in Tamboul Abattoir, Central Sudan, to find out and describe the macroscopic and microscopic lesions in camels slaughtered during a period of three months. All examined camels were subjected to haematological analysis before slaughter. Out of 100 condemned lungs 41% had pneumonia, 19% hydatid cysts, 11% emphysema, 9% congestion, 6% fibrosis, 3% aspirated blood, 3% oedema, 3% adhesions, 3% abscesses, 2% calcification and 1% had necrotic foci. The results of the haematological analysis indicated insignificant changes in the erythrocytic indices of camels with pulmonary lesions compared with those of camels with normal lungs. However, the total leucocytes counts were significantly higher in the camels that had lung lesions compared with those without lung lesions. Neutrophils and lymphocytes counts were relatively higher in the camels with lung lesions. Pneumonia and hydatidosis were the main causes of condemnation of lungs of camels slaughtered at Tamboul Abattoir.

**Key words:** Camels, haematology, lungs, pathology

The non-sedentary nature of camel herds which are constantly moving in search of grazing and water is one of the major constraints that face research in camel diseases including respiratory diseases. Pulmonary lesions as evidence of respiratory diseases of camels have been investigated. Bani Ismail (2017) diagnosed bacterial and viral agents causing pneumonia in camels. Affected camels had elevated leukocytes, creatinine, urea and protein. Jenberie *et al* (2012) diagnosed pulmonary lesions of camels. Pulmonary lesions in camels were also reported by Abdelrahim *et al* (1990) in Libya, Zubair *et al* (2004) in Pakistan, Nourani and Rohani (2009) in Iran, Abubakar *et al* (2011) in Nigeria and Muskin and Moti (2011) in Ethiopia. Similarly, few studies have been published in this field in the Sudan (Tigani *et al*, 2007 and Nasar Eldien, 2010).

The haematological effects of pulmonary lesions on camels also seem to be investigated by few workers including Abubakar *et al* (2011) in Nigeria. The present work was, therefore, carried out to investigate the pathological and haematological effects of lung lesions on camels in Central Sudan.

## Materials and Methods

### *The study area*

The study was conducted at Tamboul Abattoir, 150 km south of Khartoum North, Central Sudan. Tamboul is the largest camel market in the Sudan with more than 90 camels slaughtered every week.

### *Collection of condemned lungs, histopathological and blood samples*

One hundred lungs condemned due to pulmonary lesions were randomly collected from slaughtered camels of both sexes and different ages. The collected lungs were grossly examined and the observed pathological changes were described. Samples were taken from prominent lesions and fixed in 10% neutral buffered formalin. These were processed, embedded in paraffin wax and sectioned at 5µm. Sections were dewaxed and stained with haematoxylin and eosin (H & E) for histopathological examination.

Blood samples for the determination of blood indices were collected before slaughter of all camels in clean vials containing ethylene diamine tetracetic acid (EDTA). Samples from camels identified later as having

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lung lesions were kept while others were discarded except the samples required as normal controls. Twenty three blood samples were randomly chosen from the samples from camels with lung lesions and 14 samples were chosen as controls from normal camels without lung lesions. Haemoglobin (Hb) values were determined by the cyanomethaemoglobin method using a haemoglobinometer (Evans Electroselenium, UK). Packed cell volume (PCV) was measured by a haematocrit centrifuge (Hawksley and Sons Ltd, UK). Total red (RBC) and white (WBC) blood cell counts were made in an improved Neubauer haemocytometer (Hawksley and Sons, UK). The mean corpuscular volume (MCV) and mean corpuscular haemoglobin concentration (MCHC) were calculated according to Kerr (1991). Differential leucocyte counts were made on thin blood films stained with Wright-Leishman stain and at least 200 cells were counted on each film using the battlement technique (Kerr, 1991).

### Statistical analysis

Haematological values were analysed using the statistical package of social science (SPSS). Analysis of variance was used to assess the significance of difference. P values higher than 0.05 were considered insignificant.

## Results

### Causes of lung condemnation:

The different causes of lungs condemnation of slaughtered camels in Tamboul Abattoir are listed in Table 1.

**Table 1.** Causes of condemnation of lungs from camels slaughtered at Tamboul Abattoir.

Cause of condemnation	Condemned lungs	
	No. of lungs	Rate of condemnation (%)
Pneumonia	41	41
Hydatid cysts	19	19
Emphysema	11	11
Congestion	9	9
Fibrosis	6	6
Aspiration of blood	3	3
Oedema	3	3
Adhesions	3	3
Abscesses	2	2
Calcification	2	2
Necrotic foci	1	1
	100	100

**Pneumonia:** Pneumonia was found to be the cause of the highest percentage of lung

condemnations (41%) as compared with other causes. All stages of pneumonia were seen including congestion, red hepatisation, grey hepatisation (Fig 1) and consolidation. Many lungs which showed grey hepatisation had multiple foci of consolidation with dark greyish colour and lobular appearance. The lesions were more pronounced in the apical lung lobes. Histopathological examination indicated evidence of bronchopneumonia (Fig 2), interstitial pneumonia (Fig 3) and necrotic pneumonia.

### Hydatid cysts

Hydatidosis was found to be the second cause of lungs condemnation (Fig 4). The number of hydatid cysts varied from 1 to 10 and their sizes ranged from 2 to 20 centimetres, in a single lung. Some cysts were caseated.

### Emphysema

Emphysematous camel lungs were enlarged in size, flabby, pale in colour and easily compressed by finger.

### Fibrosis

Fibrosis was seen as excessive fibrous connective tissue in the lung.

### Aspiration of blood

Raised plaques were found scattered all over the lung due to aspirated blood.

### Oedema

Oedematous lungs were enlarged, increased in weight and fluid was released when the surface of the lung was cut.

### Abscesses

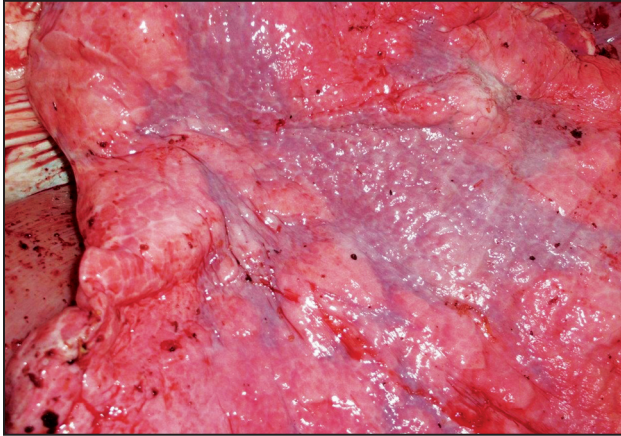
Abscesses were found in the form of nodules with various sizes. They had raised surfaces and were greyish white in colour. Upon cutting, they yielded inspissated pus which was sometimes gritty in nature.

### Calcification

White to grey calcium deposits were found in some lungs. The deposits were irregularly round with a gritty feeling when sliced with a knife.

### Other lesions

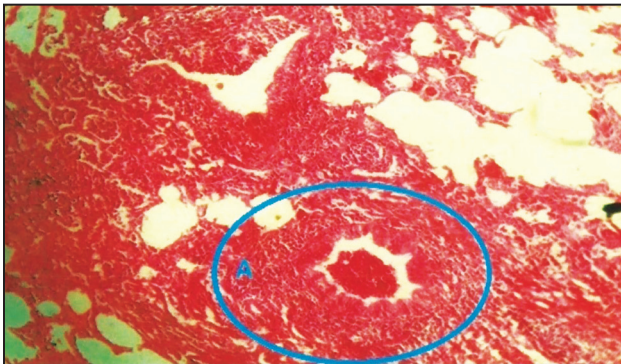
These included congestion of some lungs which looked bright red in colour with areas of atelectasis. These areas appeared dull red, hard and depressed at the lung surface. Other lungs showed areas of adhesions on their surface.



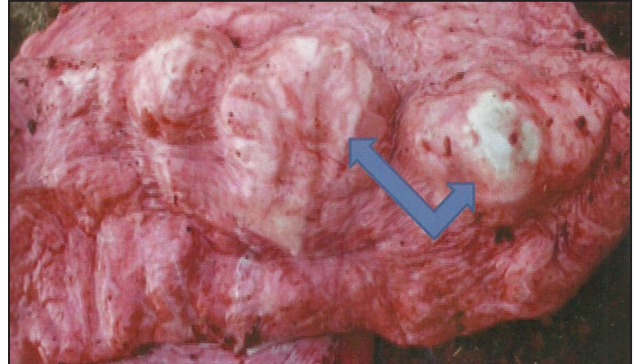
**Fig 1.** Grey hepatisation indicating pneumonia.



**Fig 2.** Bronchopneumonia (mononuclear cells and neutrophils infiltration inside the bronchi and hyperplasia of the bronchiolar epithelium, H&E X100).



**Fig 3.** Interstitial pneumonia (thickening of the interstitial tissue and infiltration of inflammatory cells between the alveoli, H&E X100).



**Fig 4.** Hydatid cyst.

## Haematological findings

### Erythrocytic indices

Table 2 shows the erythrocytic indices of camels without pulmonary lesions compared with those with pulmonary lesions. The differences between the values in the two groups were statistically insignificant.

**Table 2.** Erythrocytic indices of camels without and with lung lesions.

Parameter	Camels without lung lesions (n = 14)	Camels with lung lesions (n = 23)
RBC (X10 <sup>6</sup> /μ)	3.8±0.9	4.6±0.5
Haemoglobin (g/dL)	9.8±0.5	10.5±0.5
PCV %	31.4±2.3	31.5±1.2
MCV (fl)	55.5±4.9	55.6±11.0
MCH (pg)	32.2±10.0	28.4±3.8
MCHC/(g/dl)	33.2±0.1	33.3±0.08

### Leucocytic indices:

The leucocytic indices of camels without and with pulmonary lesions are shown in Table 3. The total

leucocytes counts were significantly increased ( $P < 0.05$ ) in camels with lung lesions. The counts of neutrophils, eosinophils, basophils, lymphocytes and monocytes were, however, not statistically different in the two groups, but relative increases in the neutrophils and lymphocytes in camels with lung lesions were found.

**Table 3.** Leucocytic indices of camels without and with lung lesions.

Parameter	Camels without lung lesions (n = 14)	Camels with lung lesions (n = 23)
WBC (X10 <sup>3</sup> /μl)	7.3±0.5	9.3*±0.6
Neutrophils (X10 <sup>3</sup> )	3.39±0.5	4.48±1.2
Eosinophils (X10 <sup>3</sup> )	0.33±1.3	0.31±0.4
Basophils (X10 <sup>3</sup> )	0.03±0.04	0.006±0.05
Lymphocytes (X10 <sup>3</sup> )	3.32±0.8	3.93±1.3
Monocytes (X10 <sup>3</sup> )	0.42±1.2	0.52±0.5

\* $P < 0.05$  was considered statistically significant

## Discussion

The results showed that pneumonia was the most important cause of condemnation of slaughtered



camels lungs in Tamboul Abattoir at Central Sudan (41%). Comparable findings indicating pneumonia as an important cause of condemnation of slaughtered camel lungs were previously reported by Tigani *et al* (2007) and Nasar Eldien (2010). The former and latter workers reported condemnation rates of lungs of camels slaughtered in Nyala (Western Sudan) and Tamboul (Central Sudan) as 32% and 57%. Likewise, Zubair *et al* (2004) found a condemnation rate of 45% of slaughtered camel lungs due to pneumonia in Pakistan and Abubakar *et al* (2011) reported a condemnation rate of 46.4% in Nigeria.

The second important cause of lung condemnation in the present investigation was hydatidosis (19%). In a similar survey in Ethiopia, Muskin and Moti (2011) reported a condemnation rate of 22.6% of slaughtered camel lungs. Tigani *et al* (2007) and Nasar Eldien (2010) reported higher condemnation rates of camel lungs infected with hydatidosis in Western and Central Sudan. These were 40.4% and 31.2% consecutively. Likewise, Nourani and Rohani (2009) found that hydatidosis was the most prevalent pulmonary infection in Iran (51%). Etana Debela *et al* (2015) reported that the highest proportion of hydatid cysts were recorded in the lungs (56%) followed by the liver (33.9%), the spleen (7.3%) and the kidneys (2.8%).

Mixed infections of hydatidosis and pneumonia were found in some condemned lungs in the present investigation indicating the possible role of hydatidosis as a predisposing factor for secondary infections which lead to pneumonia.

Congestion and fibrosis were the causes of 9 and 6% of condemned camel lungs in Tamboul Abattoir as shown by the results of the present investigation. Similar rates (9.2 and 6.0%) were previously reported by Nasar Eldien (2010) in an investigation carried out in the same abattoir.

The condemnation rate due to fibrosis was found to be slightly lower (4.4%) in Western Sudan by Tigani *et al* (2007).

Aspiration of blood as a cause of camel lungs condemnation was found to be 3% in the present investigation. A similar rate was reported by Tigani *et al* (2007) in Western Sudan. The rate reported by Nasar Eldien (2010) in Central Sudan was about 5 times higher (14.4%). This may be due to differences in slaughtering methods.

The percentages of adhesions and abscesses as causes of condemnation of slaughtered camel lungs in the present investigation were similar to those

reported by Tigani *et al* (2007) in Western Sudan. They were, however, higher than the percentages previously reported by Nasar Eldien (2010) in Tamboul Abattoir (0.8%).

Pulmonary lesions had little effect on the erythrocytic indices of affected camels as the differences between these indices in the affected and normal camels were statistically insignificant. These findings were comparable to those reported by Abubakar *et al* (2011) in a similar investigation in Nigeria.

The values of these erythrocytic indices were found comparable to those reported by Abdelgadir *et al* (1979) and Barakat *et al* (2007) in the Sudan. They were also comparable with those reported by Abubakar *et al* (2011) in Nigeria and Farooq *et al* (2011) in Pakistan.

The results, however, showed a statistically significant increase in the total leucocytes count of camels with pulmonary lesions when compared with those which had no pulmonary lesions. It is likely that this increase is associated with the inflammatory process initiated by the various etiological factors which lead to the pulmonary lesions in the affected camels. Nigerian camels with pulmonary lesions also showed an increase in the total leucocytes counts when compared with the counts in normal camels (Abubakar *et al* 2011).

The relative increase in neutrophil counts in the camels with pulmonary lesions in the present investigation may be attributed to purulent inflammations in the camels which had abscesses. The slight increase in the lymphocyte counts, on the other hand, may be due to chronic inflammatory processes in some of the camels with pulmonary lesions. Lymphocytes, together with macrophages, are known to comprise the main components of the inflammatory cells which prevail during chronic inflammations, particularly those initiated by bacterial infections (Johnes *et al*, 1997; Muna *et al*, 2017).

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