RESEARCH ARTICLE

Clinico-Pathological Findings of Fibrinous Pneumonia in Sheep with Reference to Bacterial Etiology

Kaluvai Sahithi*, Soujanya Samala, Boinepally Ramya, Katta Charith, Karumuru Jessie Irvine Raj, Nalabothula Laxmi Prasanna, Doggela Prathibha

Abstract

Fibrinous pneumonia is an acute, significant respiratory disease in sheep, characterized by inflammation and prominent deposition of fibrin in lung tissue, commonly associated with *Mannheimia haemolytica*, *Pasteurella multocida* and *Escherichia coli*. This article presents the incidence of fibrinous pneumonia including diagnosis, clinical presentation, gross lesions, histopathology and bacterial isolation. A total of 60 sheep that died during April 2025 to March 2026 were brought for postmortem examination to the Department of Veterinary Pathology of the College in Hyderabad. Pneumonia was recorded in 66.66% (40/60) cases, of which 43.33% (26/60) were fibrinous pneumonia. High prevalence (76.92%) of fibrinous pneumonia was observed in young lambs compared to adults (23.08%). Clinically affected sheep exhibited severe respiratory distress, coughing, mucoid discharges and crust formation around nostrils. Necropsy revealed extensive fibrin deposition over cranio-ventral lung lobes and pleura, pleural adhesions to the thoracic wall and accumulation of clear, watery yellow color fluid in the thoracic cavity. Histologically, alveoli were filled with fibrin, desquamation of bronchiolar epithelium, interstitial edema, fibrin deposition on pleura and in the interstitial space. Cultural examination of lung tissue revealed high prevalence of fibrinous pneumonia due to *P. multocida* (46.15%), followed by *M. haemolytica* (30.77%) and *E. coli* (23.08%).

Keywords: Bacterial isolation, Fibrinous pneumonia, Gross pathology, Histopathology, Sheep.

Ind J Vet Sci and Biotech (2026): 10.48165/ijvsbt.22.5.17

Introduction

Pneumonia is known to be a common disease of small ruminants and it significantly reduces growth, productivity and the wool quality. Pneumonia is more prevalent in young lambs and kids than adults, as maternal immunity declines after few days of birth (Mohamed and Abdelsalam, 2008; Samadipoor *et al*., 2024). Pneumonic Pasteurellosis is one of the most frequently encountered diseases which cause mild illness to severe respiratory distress. The condition is characterized by acute onset of high fever, yellow greenish mucoid nasal discharges, dyspnea accompanied by painful coughing, open mouth breathing and in severe cases extension of head and neck, congestion of nasal mucous membrane, sneezing, bilateral or unilateral lacrimation, lateral recumbency and death within 72 h (Walsh *et al.,* 2016). Auscultation often reveals marked attenuation of lung sounds in cranioventral region due to fibrinous pleurisy (Scott, 2010). Postmortem findings typically include enlarged lungs with black-bluish discoloration and areas of consolidation, fibrinous adhesions between lungs, pleura and thoracic wall (Amaravathi, 2014).

Mannheimia haemolytica and *Pasteurella multocida* are normal inhabitants of upper respiratory tract but act as opportunistic pathogens under stress conditions such as overcrowding, sudden environmental changes, transportation stress, and defective management (Maxie, 2015; Legesse *et al.,* 2018). The pathogen produces leukotoxins and other virulence factors that damage the pulmonary epithelium and trigger an intense inflammatory response. This results in the exudation of fibrin into the alveolar spaces and interlobular septa, coupled with neutrophil infiltration and capillary leakage. As the disease rapidly evolves, extensive consolidation and pleural involvement may occur, compromising gas exchange and leading to the clinical signs of respiratory distress (Quinn *et al.,* 2011; Kumar *et al*., 2014; Hussain *et al.,* 2017). Opportunistic secondary bacteria, including *Escherichia coli*, significantly contribute to the advancement and increased severity of lung lesions (Mahendra *et al*., 2024). These organisms carry multiple virulence factors that promote colonization, tissue invasion, and toxin release, ultimately leading to inflammation and damage to the lungs (Wang *et al*., 2024). Present study was designed to evaluate the prevalence of bacterial fibrinous pneumonia in sheep including gross and histopathology of lungs and isolation of the causative bacterial agents.

Department of Veterinary Pathology, College of Veterinary Science, PVNRTVU, Rajendranagar, Hyderabad-500030, Telangana, India

Corresponding Author: Dr. Kaluvai Sahithi, Department of Veterinary Pathology, College of Veterinary Science, PVNRTVU, Rajendranagar, Hyderabad-500030, Telangana, India. e-mail: sahithikaluvai@gmail.com

How to cite this article: Sahithi, K., Samala, S., Ramya, B., Charith, K., Jessie Irvine Raj, K., Laxmi Prasanna, N., & Prathibha, D. (2026). Clinico-Pathological Findings of Fibrinous Pneumonia in Sheep with Reference to Bacterial Etiology. Ind J Vet Sci and Biotech, 22(5), 89-93.

Source of support: Nil

Conflict of interest: None

Submitted 12/06/2026 **Accepted** 22/07/2026 **Published** 10/09/2026

© The Author(s). 2026 Open Access This work is licensed under a Creative Commons Attribution-Non Commercial-No Derivatives 4.0 International License.

Materials and Methods

Sample Collection and Preparation

Present investigation was carried out in 60 sheep which were brought for postmortem examination to the Department of Veterinary Pathology, College of Veterinary Science, Rajendranagar, Hyderabad (India) during study period of one year from April 2025 to March 2026. Necropsy was performed according to standard protocol (King *et al*., 2014). Gross lesions were noted down. Lung samples were collected aseptically for bacterial studies. Samples were incubated in Tryptose soya broth at 37 °C for 24 h, then cultured on Blood agar, BHI agar, Mac Conkey agar and Eosin Methylene Blue agar for isolation of *Pasteurella* species and *E. coli*. Identification was done based on Gram staining and colony characteristics.

Lung tissue samples of about 1 cubic centimeter were directly taken from different lesions by sterile scalpel and fixed with 10% of neutral buffered formalin for histopathological examination. The samples were dehydrated in ascending grades of ethanol, cleared by xylene, embedded in paraffin and blocks were made. Sections from blocks were cut at 5 µm by using rotary microtome, finally the samples were stained with hematoxylin and eosin (Luna, 1968).

Results and Discussion

Prevalence

In the current study, among the 60 sheep presented for postmortem examination, 40 sheep died due to pneumonia indicating the prevalence of 66.66%, and among which 26 sheep showed fibrinous type of pneumonia which indicated the prevalence of 43.33%. The high occurrence of pneumonia observed in the current study suggests that respiratory diseases are one of the major causes of mortality in sheep under field conditions. Age-wise analysis revealed that among 26 sheep, 20 were lambs between 2 to 8 months of age group and 6 were adults > 1.5 years of age group which indicated the high prevalence (76.92%) of fibrinous pneumonia in lambs compared to adult sheep (23.08%) (Table 1). Similar results were earlier reported by Scott (2011) and Sonawane *et al.* (2012). The increased susceptibility in lambs may be due to immature immunity, decline of maternal antibodies and inadequate pulmonary defense mechanisms, which predispose young animals to respiratory bacterial infections.

Clinical Signs

Affected sheep developed lethargy, anorexia and showed mucopurulent nasal discharges and respiratory signs over two days. The animals had pale mucous membranes, reduced mobility and showed severe respiratory distress before death. Clinical manifestations included hyperthermia, tachypnea, rapid deterioration and death within 48-72 h in severely affected animals. These features are hallmark of pneumonic pasteurellosis (Ekong *et al.,* 2014; Alautaish *et al*., 2024).

Gross Pathology

Necropsy revealed consolidated and firm cranioventral lung lobes (Fig. 1a) and fibrinous exudate on the pleural surface forming adhesions. Serosanguineous fluid was found on the cut section of lung. Affected lung tissue was firm due to red or grey hepatization. There was difficulty in cutting the affected part of lung due to accumulation of fibrin and consolidation. Hydrothorax was also evident (Fig. 1b). These lesions are considered characteristic features of fibrinous pleuropneumonia and are in agreement with the findings of Ekong *et al*. (2014) and Mahdi *et al*. (2022). Hydrothorax recorded in present study has similarly been documented in up to 90.3% of sheep dying from *M. haemolytica* infection in Pakistani field outbreaks. The accumulation of fluid within the thoracic cavity was mainly due to increased vascular permeability and impaired lymphatic drainage resulting from intense inflammatory reactions within pulmonary and pleural tissues (Hussain *et al.,* 2017).

Histopathology

Histopathological examination of lung tissue revealed fibrin deposition into the alveoli (Fig. 2a), desquamation of bronchial epithelium and congestion of alveolar capillaries (Fig. 2b), thickened pleura with fibrin deposition and infiltration of inflammatory cells (Fig. 2c), and excessive fibrin deposition in the interstitial spaces replacing the alveolar parenchyma (Fig.2d). Bronchiectasis and flattening of bronchial epithelium were also noticed (Fig. 2e). Edema, emphysema, deposition of fibrin along with lymphocytes, macrophages, neutrophils was evident in interstitial space (Fig. 2f). The findings of fibrin deposition in alveoli and bronchioles, neutrophilic infiltration, pleural thickening, vascular congestion, and areas of emphysema, edema and bronchiectasis in present study are consistent with the descriptions made by multiple investigators (Kumar *et al.,* 2014; Mahdi *et al.,* 2022; Samadipoor *et al.,* 2024).

Table 1: Prevalence of fibrinous pneumonia in sheep

Category		Total no. of carcass examined	No. of affected animals	Prevalence (%)
All types of pneumonia		60	40	66.66
Fibrinous pneumonia		60	26	43.33
Age group	Lambs (2-8 Months)	26	20	76.92
	Adults (>1.5 years)	26	6	23.08



Fig. 1(a-b): Gross lesions of fibrinous pneumonia in sheep. 1a) Fibrin deposition on lungs and cranio-ventral pulmonary consolidation in sheep with fibrinous pneumonia, **1b**) Hydrothorax with straw colored fluid in thoracic cavity and adhesions between pleura & thoracic wall in sheep with fibrinous pneumonia.

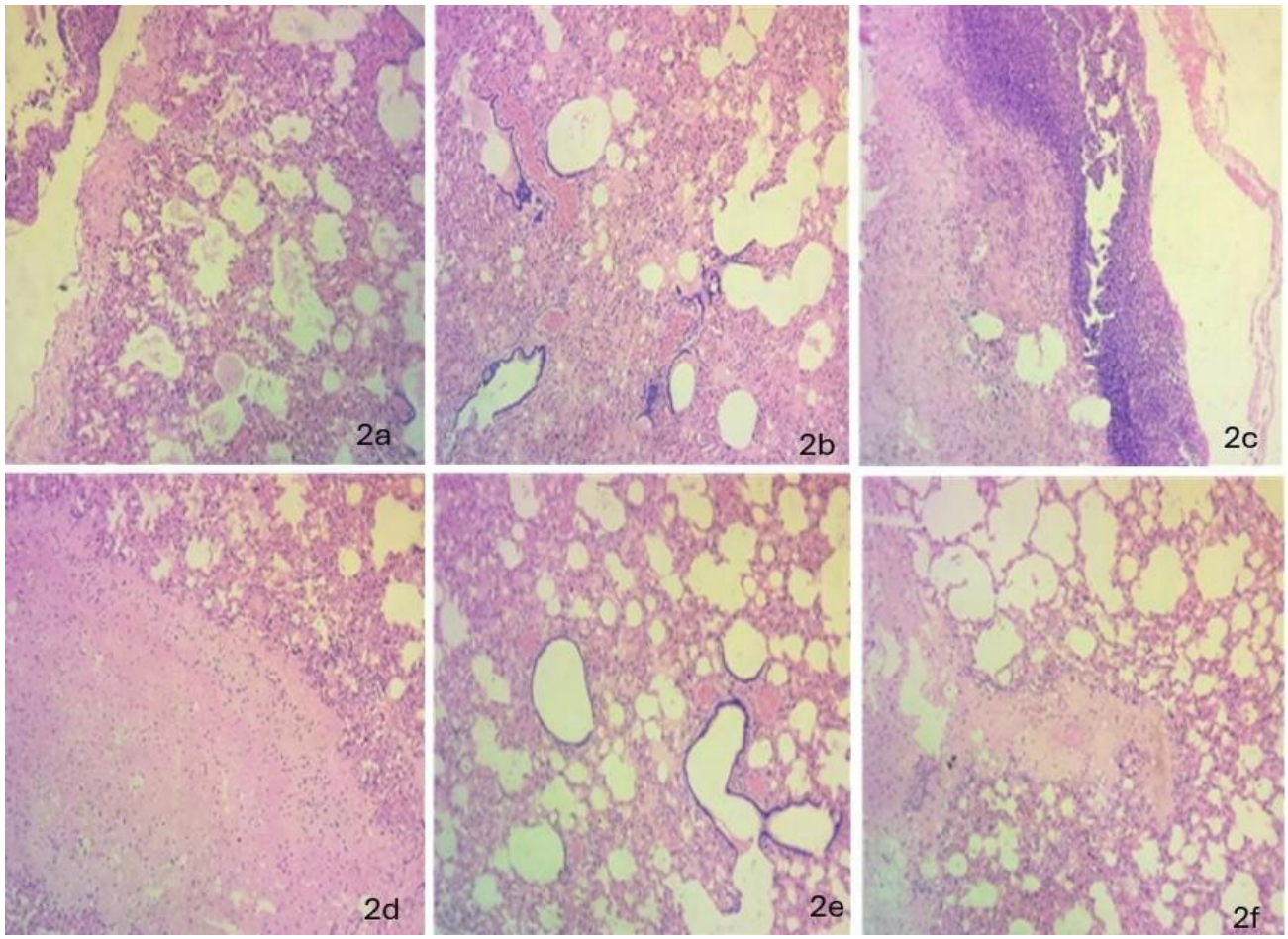


Fig. 2(a-f): Histopathological lesions in lungs with fibrinous pneumonia in sheep. 2a) Intra-alveolar fibrin deposition in lung. H&E 100X. **2b**) Lung section showing congestion of alveolar capillaries and desquamation of brochiolar epithelium. H&E 100X. **2c**) Deposition of fibrin on pleura and infiltration of inflammatory cells. H&E 100X. **2d**) Lung lesion showing fibrin in interstitium replacing the alveolar parenchyma. H&E 100X. **2e**) Bronchiectasis and flattening of bronchial epithelium in lung section. H&E 100X. **2f**) Lung section showing edema, emphysema, deposition of fibrin and inflammatory cells in interstitial space. H&E 100X.

Isolation and Identification of Bacteria

From a total of 26 fibrinous pneumonic lung tissues, *P. multocida*, *M. haemolytica* and *E. coli* organisms were isolated from 12, 8 and 6 tissues, respectively, which indicated that the higher prevalence of fibrinous pneumonia was due to *P. multocida* (46.15%) followed by *M. haemolytica* (30.77%) and *E.coli* (23.08%)(Table 2).

Table 2: Prevalence of various types of bacteria isolated from fibrinous pneumonia of sheep

Bacterial organism	No. of tissues	Prevalence (%)
P. multocida	12	46.15
M. haemolytica	8	30.77
E. coli	6	23.08
Total isolates	26	100.0

E. coli growth produced a green metallic sheen on EMB agar (Fig. 3a) and Gram staining revealed pink bacilli under microscope (Fig. 3b). *P. multocida* formed non-haemolytic, small, glistening, mucoid colonies on 5% sheep blood agar (Fig. 4a) and with no growth on Mac Conkey agar. In contrast, *M. haemolytica* produced small pink colonies on Mac Conkey agar (Fig. 4b), smooth, greyish hemolytic colonies on 5% blood agar and Gram staining of these colonies revealed characteristic pink bipolar staining appearance (Fig. 4c). *P. multocida* formed small, gray, lustrous, smooth and non-hemolytic colonies on BHI agar (Fig. 4d). Biochemical tests showed that both were positive for catalase, oxidase, nitrate reduction, and fermented glucose, mannose, and sucrose, while urease was negative. *M. haemolytica* was indole negative, whereas *P. multocida* was indole positive but did not ferment lactose or maltose. The biochemical reactions observed in the present investigation corresponded with the standard diagnostic characteristics described by Quinn *et al.* (2011).

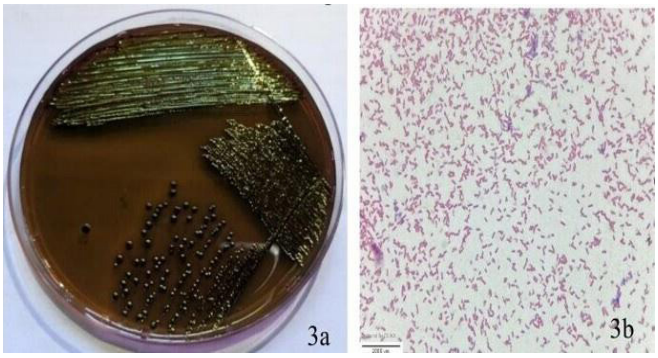


Fig. 3(a-b): Isolation of *E. coli*. 3a) Green metallic sheen of *E. coli* colonies on EMB agar. **3b**) Gram staining of *E. coli* showing Gram negative bacilli.

The bacteriological findings of the present study indicated that *P. multocida*, *M. haemolytica* and *E. coli* were the primary isolates from fibrinous pneumonia which corroborated with the earlier investigations (Abdulkadir *et al.*, 2024). Current study showed that the occurrence of fibrinous pneumonia in sheep was high due to *P. multocida*. Similarly, Samadipoor *et al. (*2024) concluded *P. multocida* (28.57%) as the most frequent pathogen from pneumonic sheep lungs. The pathogenesis of fibrinous pneumonia depends on stressors which compromise mucociliary clearance, innate pulmonary defenses and permitting *M. haemolytica* or *P. multocida* to colonize on the lower respiratory tract (Hussain *et al.,* 2017).

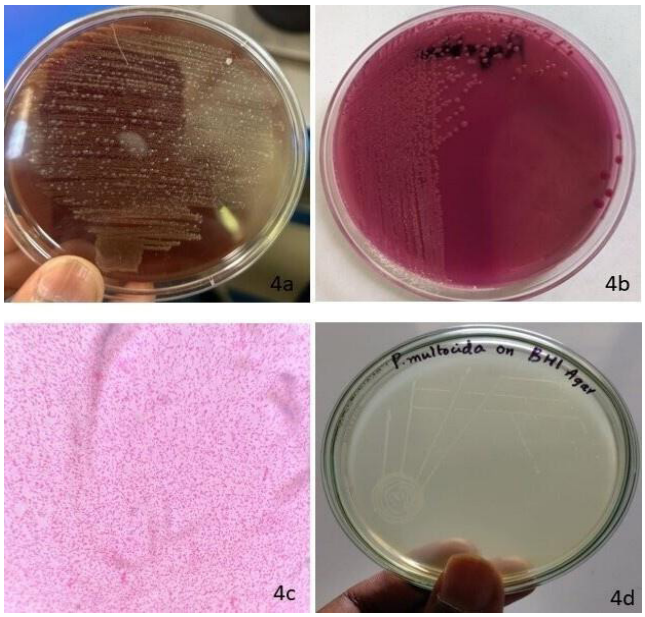


Fig. 4 (a-d): Isolation of various bacteria involved in fibrinous pneumonia of sheep. 4a) Non- hemolytic, small, glistening and mucoid colonies of *P. multocida* on 5% sheep blood agar. **4b**) Pink colonies of *M. hemolytica* on Mac Conkey agar. **4c**) Bipolar *M. hemolytica* on gram staining. **4d**) Gray, lustrous, smooth and non- hemolytic colonies of *P. multocida* on BHI agar.

Conclusion

Fibrinous pneumonia poses a considerable risk to sheep populations, given its rapid progression and potential to cause high mortality. This study illustrates the classical clinical signs and pathological aspects of the disease, reinforcing the importance of early diagnosis and comprehensive flock management. Microbiological investigations and pathogen isolation conducted revealed the presence of *M. haemolytica*, *P. multocida and E. coli* in lung tissue with fibrinous pneumonia. Continued research into pathogenesis, along with vigilant preventive efforts, is vital for optimal health outcomes in sheep. Fibrinous pneumonia can rapidly progress, leading to severe respiratory compromise and, if left untreated, increased mortality within the affected flocks. Early intervention with appropriate antimicrobial therapy and supportive care is critical to improve outcome and limit the spread among susceptible animals.

Acknowledgement

We are thankful to the Dean, Faculty of Veterinary Science PVNRTVU, Rajendranagar, Hyderabad for providing the facilities to carry out this work.

References

Abdulkadir, M., Nigussie, T., & Kebede, I.A. (2024). Isolation and identification of *Pasteurella multocida* and *Mannheimia haemolytica* from pneumonic small ruminants and their antibiotic susceptibility in Haramaya district, Eastern Ethiopia. *The Scientific World Journal, 2024*(1), 5605552.

Alautaish, H.H.N., Mohammed, Y.J., Muhsen, R.K., & Muhammad, I.A.W. (2024). Clinical and pathological studies of pneumonia in sheep in Basrah. *Pakistan Journal of Life and Social Sciences*, *22*(2), 3926-3931.

Amaravathi, M. (2014). Pathomorphological studies on spontaneous lung lesions in slaughtered sheep. *Master's Thesis*. Sri Venkateswara Veterinary University, Tirupati, India.

Ekong, P.S., Akanbi, B.O., & Odugbo, M.O. (2014). A case report of respiratory mannheimiosis in sheep and goat complicated by *Bordetella parapertussis. Nigerian Veterinary Journal 35*(2), 968-974.

Hussain, R., Mahmood, F., Ali, H.M., & Siddique, A.B. (2017). Bacterial, PCR and clinico-pathological diagnosis of naturally occurring pneumonic pasteurellosis (Mannheimiosis) during subtropical climate in sheep. *Microbial Pathogenesis*, *112*, 176-181.

King, J.M., Roth-Johnson, L., Dodd, D.C., & Newsom, M.E. (2014). *The Necropsy Book*: A guide for veterinary students, residents, clinicians, pathologists, and biological researchers. The Internet-First University Press.

Kumar, M.A., Kumar, R., Varshney, K.C., Nair, M.G., Lakkawar, A.W., Sridhar, B.G., & Palanivelu, M. (2014). Pathomorphological studies of lung lesions in sheep. *Indian Journal of Veterinary Pathology*, *38*(2), 75.

Legesse, A., Abayneh, T., Mamo, G., Gelaye, E., Tesfaw, L., Yami, M., & Belay, A. (2018). Molecular characterization of *Mannheimia haemolytica* isolates associated with pneumonic cases of sheep in selected areas of Central Ethiopia. *BMC Microbiology*, *18*(1), 1-10.

Luna, G.L.H.T. (1968). *Manual of Histological and Special Staining Techniques*. 2nd edn., The Blakistone Divison, McGraw-Hill Book Company, Inc. New York, Toronto, London: 1-5 and 9-34.

Mahdi, Z.S., Hashim, M.S., Karim, A.J., & Mahmood, T.A. (2022). Pathological study of the main pulmonary infections isolated from sheep in Holy Kerbala province. *Journal of Genetic and Environment Conservation*, *10*(2), 163-170.

Mahendra, M., Patil, N.A., Vivek, R.K., Awati, B., & Kulkarni, S. (2024). Diagnosis and management of bacterial pneumonia in sheep. *International Journal of Advanced Biochemistry Research,* 8(11S), 564-572.

Maxie, G. (2015). Jubb, Kennedy & Palmer's *Pathology of Domestic Animals*: 6th edn., Vol. 2, Elsevier Health Sciences, pp. 544-547.

Mohamed, R.A., & Abdelsalam, E.B. (2008). A review on pneumonic pasteurellosis (respiratory mannheimiosis) with emphasis on pathogenesis, virulence mechanisms and predisposing factors. *Bulgarian Journal of Veterinary Medicine*, *11*(3), 139-160.

Quinn, P.J., Markey, B.K., Leonard, F.C., FitzPatrick, E.S., Fanning, S., & Hartigan, P.J. (2011). *Veterinary Microbiology and Microbial Disease.* 2nd edn., Wiley-Blackwell, pp. 261-268.

Samadipoor, M., Mohammadi, P., Farjanikish, G., Masoudifard, M., & Esmaeili, H. (2024). Radiographic, microbiologic, and pathologic study of pneumonia in imported sheep and goats. *Iranian Journal of Veterinary Surgery*, *19*(1), 43-50.

Scott, P.R. (2010). Lung auscultation recordings from normal sheep and from sheep with well-defined respiratory tract pathology. *Small Ruminant Research*, *92*(1-3), 104-107.

Scott, P.R. (2011). Treatment and control of respiratory disease in sheep. *Veterinary Clinics: Food Animal Practice*, *27*(1), 175-186.

Sonawane, G.G., Singh, F., Tripathi, B.N., Dixit, S.K., Kumar, J., & Khan, A. (2012). Investigation of an outbreak in lambs associated with *Escherichia coli* O95 septicaemia. *Veterinary Practitioner, 13*(1), 73-75.

Walsh, D.P., Cassirer, E.F., Bonds, M.D., Brown, D.R., Edwards, W.H., Weiser, G.C., & Besser, T.E. (2016). Concordance in diagnostic testing for respiratory pathogens of bighorn sheep. *Wildlife Society Bulletin*, *40*(4), 634-642.

Wang, M., Li, X., Guo, G., Rehman, M.N.U., Gao, X., Fan, L., & Zheng, J. (2024). Emergence of highly virulent and multidrug-resistant Escherichia coli in breeding sheep with pneumonia, Hainan Province, China. *Frontiers in Microbiology*, *15*, 1479759