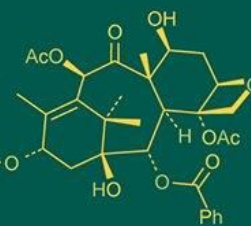
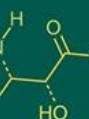
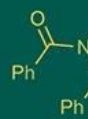


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Welfare and health management practices implemented during a sheep pox outbreak in indigenous sheep flocks: A case study from Tamil Nadu, India

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Abstract

The current study focused on eight indigenous sheep flocks (total n=1200) in Thalaiyal Nandanthan Kulam village, Kayathar block, Kovilpatti taluk, Thoothukudi district, Tamil Nadu. The flocks experienced clinical signs of pyrexia, anorexia, dullness, rhinitis with mucopurulent nasal discharge, and cutaneous papules progressing to pustules and scabs over a 10-day period in June 2021, resulting in mortality. Cutaneous lesions were predominantly observed all over the body including face, nostrils, ear lobes and tail base. Post-mortem revealed pock lesions in the trachea, lungs, tongue, and kidney. The detailed necropsy examination was performed and the samples were collected including nasal swabs, pock swabs, whole blood, and tissues from affected organs were collected and submitted to the Central University Laboratory, TANUVAS, Chennai and confirmed as sheep pox. Management included isolation of infected animals, antibiotics to control secondary bacterial infections, oral immune boosters, disinfection, movement control, surveillance, and ring vaccination of susceptible sheep population (n=6600) to lower mortality rate. Welfare measures followed the Five Freedoms framework to minimize suffering and support early recovery. The affected animals recovered clinically.

Keywords: Cutaneous lesion, outbreak, management, mortality, sheep pox

Introduction

Sheep farming is essential to the livelihoods of marginal and landless farmers since it improves household nutrition and generates a substantial amount of revenue. With 74.26 million sheep, India has the fourth-largest sheep population in the world, behind China, Australia, Sudan, and Iran, according to the 2019 livestock census (Manjunatha Reddy *et al.*, 2024) [3]. Sheep farming in India is a major sector of agriculture, especially for small and marginal farmers, owing to its minimal investment needs and adaptability to diverse environments. India significantly contributes to the improvement of rural lives and food security through sheep production. Sheep farming has potential, but it also has limitations, including poor market accessibility, diseases, and insufficient infrastructures. Efficient management methods are crucial for maximising output and health, involving appropriate healthcare and nutrition (Bhanuprakash *et al.*, 2011) [1].

In India, infectious diseases significantly impact sheep farming, leading to considerable morbidity and mortality, which in turn cause economic losses for farmers. These diseases affect sheep of all ages and are influenced by various factors such as season, sex, and breed. Key issues include poor hygiene, inadequate veterinary care, and intensified farming, which leads to problems like respiratory infections and specific viral infections like sheep pox. Morbidity and mortality rates peak during the rainy season due to increased prevalence of diseases (Pavan kumar *et al.*, 2021; Tadesse *et al.*, 2022) [7, 11].

Sheep pox is a highly contagious viral disease caused by Sheeppox virus (genus Capripoxvirus). It primarily affects sheep, leading to symptoms such as fever, skin lesions, respiratory distress, weight loss, and, in severe cases, mortality, which results in decreased productivity, increased veterinarian costs, and substantial economic losses. The disease is seasonally prevalent, with the highest incidence during the rainy seasons (Pavan kumar *et al.*,

2021)^[7]. The current study reports the incidence of sheep pox and its welfare and health management in indigenous sheep flocks located in the Thoothukudi District of Tamil Nadu.

Materials and Methods

The current study examined eight indigenous sheep flocks with the total strength of 1200 in Thalaiyal Nandanthan Kulam village, Kayathar block, Kovilpatti taluk, Thoothukudi district of Tamil Nadu. The sheep showed signs of pyrexia, anorexia, dullness, rhinitis with mucopurulent nasal discharge, and cutaneous lesions throughout a 10-day period, and 19 animals died during June 2021. Clinical examinations and necropsy were carried. Samples including nasal swabs, pock lesion swabs, whole blood, and tissues from affected organs were collected from clinically affected animals and submitted to the Central University Laboratory, TANUVAS, Madhavaram, Chennai for confirmatory diagnosis.

Results and Discussion

In this study, the affected sheep were of both sexes and all age groups, and the disease occurrence was during the month of June with 1.58% mortality (19 deaths) and 5.75% morbidity (69 cases), which concurred with the earlier reports of seasonal peaks during monsoon. The low mortality (1.58%) and containment through ring vaccination align with effective prompt interventions reported in similar Tamil Nadu outbreaks (Manimaran *et al.*, 2017; Roy *et al.*, 2008)^[4, 8].

The affected animals presented with pyrexia, anorexia, dullness, rhinitis, mucopurulent nasal discharge, and cutaneous papules predominantly noticed on the face, nostrils (Fig.1&2), tail base (Fig.3), ear lobes, and dispersed all over the body. Postmortem examination (Fig.4) revealed pock lesions in the respiratory tract *viz.*, trachea (Fig.5) and lungs, and also in the tongue (Fig.6) and kidney (Mondal *et al.*, 2004)^[5]. Pathological findings, such as pock lesions in respiratory tract and internal organs, are consistent with previous reports from indigenous breeds in the region (Sivaseelan *et al.*, 2005; pathological study on Mecheri flock)^[10].

Ring vaccination (Fig.7) indicating immunizing susceptible animals in a defined radius around affected flocks rapidly builds an immune barrier to halt transmission. In the described case, vaccinating 6600 sheep within an 8 km radius prevented further spread. (Omkar *et al.*, 2024)^[6]. Since sheep pox is viral, no specific antiviral exists; antibiotics (e.g., broad-spectrum like oxytetracycline or penicillin) target secondary bacterial infections that exacerbate lesions, pneumonia, and mortality (Fig.8).

Oral immune boosters (e.g., vitamins, minerals, or herbal supplements) support recovery by enhancing immunity during the acute phase. In comparable Tamil Nadu outbreaks, affected animals received antibiotic courses, leading to clinical recovery in survivors, mirroring the low mortality (1.58%) (Gomes *et al.*, 2023)^[2]. Isolating infected animals until -recovery prevent the spread of infection. Thorough cleaning and disinfection of sheds, equipment, and surroundings reduces environmental persistence of the pox virus and its spread. For welfare the Five Freedoms ensured ethical management during outbreak like providing balanced rations and clean water to combat anorexia/pyrexia-related dehydration; adequate shelter/space

(Fig 9 & 10) to reduce discomfort from lesions and overcrowding; pain alleviation through supportive care and minimal handling to limit stress/fear; and space for rest/normal behavior. Post-outbreak recommendation for yearly vaccination in endemic areas is crucial. In high-risk areas, routine immunization builds herd immunity, reducing future incidence and economic losses to farmers (Senthilkumar and Thirunavukkarasu 2010; Yogisharadhya *et al.*, 2011)^[9, 12].



Fig 1 & 2: Sheep – Head showing multifocal cutaneous papules progressing to pustules and scabs.



Fig 3: Sheep – Tail – Hairless region showing dispersed cutaneous lesions.



Fig 4: Necropsy examination of sheep carcass affected with pox



Fig 5: PM Sheep – Trachea – Mucosal congestion with pock lesions and mild frothy exudate



Fig 6: PM Sheep – Tongue – Dorsal surface showing white coalescing circular pock lesion with raised borders



Fig 7: Ring vaccination around the outbreak region



Fig 8: Health monitoring and treatment in the affected population



Fig 9: Avoiding heatstress with proper shades during day time



Fig 10: Containment of affected animals with proper fencing

Conclusion

Infectious diseases like sheepox, pneumonia, bluetongue, and PPR continue to devastate sheep farming in India, inflicting high morbidity (10-30%) and mortality rates across all ages, breeds, and seasons, compounded by poor hygiene, overcrowding, seasonal migrations, and inadequate veterinary care, resulting in severe economic losses from livestock deaths, reduced productivity, and treatment costs. Effective control demands urgent implementation of mandatory vaccinations, enhanced biosecurity measures, improved housing hygiene, and widespread farmer education programs to mitigate endemic outbreaks, particularly in vulnerable backyard and migratory flocks. Adopting these holistic strategies will safeguard sheep

health, enhance farmer livelihoods, and sustain India's vital small ruminant sector.

Disclaimer (Artificial Intelligence)

Author(s) hereby declare that NO generative AI technologies such as large language models (ChatGPT, COPILOT, etc) and text-to-image generators have been used writing or editing the manuscript.

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Competing Interest

Authors have declared that no competing interest exist.

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