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Prevalence and Control Measures of Mycoplasma Infections in Small Ruminants

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Abstract | Mycoplasma infections are a major contributor to respiratory disease in small ruminants and account for substantial financial losses in livestock production globally. This research explores the prevalence as well as control of Mycoplasma infections in sheep and goats. A cross-sectional survey was carried out on various farms, including clinical evaluation, post-mortem, as well as molecular diagnostics like PCR and culture methods. The findings had an infection prevalence of 28.7% and showed Mycoplasma ovipneumoniae and Mycoplasma agalactiae as the most commonly diagnosed species. Sick animals usually manifested with respiratory impairment, nasal discharge, and lower productivity. Risk factors of low ventilation, congestion, and low biosecurity were found to significantly correlate with high infection. Concerning control measures, the research cites early diagnosis as an effective tool, enhanced farm hygiene, continuous vaccination, planned use of antibiotics, and quarantine procedures for freshly introduced animals as the most valuable control measures. Farmer training and periodic veterinary care were also significantly effective in managing infection burden. These results call for emphasis on comprehensive management practice to prevent Mycoplasma infections and augment animal health as well as productivity on small ruminant farms.

Keywords | Mycoplasma infections, Small ruminants, Sheep and goats, Prevalence, Disease control

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INTRODUCTION

Mycoplasma infections are recognized as primary causes of respiratory and systemic diseases that significantly affect the health and productivity of small ruminants, especially goats and sheep (Gómez-Martín *et al*., 2013; Al-Saadi and Shwan, 2024). Pathogens such as *Mycoplasma ovipneumoniae* and *Mycoplasma agalactiae* are well known for causing persistent pneumonia, mastitis, arthritis, and reproductive disorders, which collectively lead to chronic herd-level losses (Akwuobu *et al*., 2014; Kadham *et al*., 2023). These infections disproportionately impact resource-poor farming systems, where access to veterinary care, preventive measures, and modern diagnostics is limited (Yatoo *et al*., 2018; Laylani *et al*., 2024; Noman and Ahmad, 2023). As a result, smallholder farmers experience considerable economic hardship due to reduced milk production, increased mortality, elevated treatment costs, and stunted animal growth (Deeney *et al*., 2021; Ahmad *et al*., 2019; Mohamad *et al*., 2025).

The continuous spread of Mycoplasma infections is mainly attributed to poor farm management practices, including overcrowded animal housing, inadequate ventilation, the absence of quarantine protocols, and shared feeding systems that accelerate disease transmission (Dudek *et al*., 2022; Zangana *et al*., 2022; Saadh *et al*., 2024). In rural areas, many livestock producers have minimal veterinary support and low awareness about disease prevention strategies, further exacerbating the problem (Paul *et al*., 2020; Ahmad *et al*., 2024; Abdulnabi *et al*., 2024). As a result, infection levels remain high, with repeated outbreaks causing continuous setbacks in affected regions (Kumar *et al*., 2014; Thabet and Alsalame, 2024; Alsalame, 2019).

Despite awareness of these risks, current control measures are insufficient. Vaccination programs are inconsistent or unavailable in many regions, and basic hygiene practices, animal segregation, and veterinary surveillance are rarely implemented effectively (Al-Momani *et al*., 2011; Govindarajan *et al*., 2023; Alsalame and Laylani, 2024). Addressing these challenges requires not only improving biosecurity protocols but also implementing farmer education initiatives and integrated disease management strategies tailored to local conditions (Chazel *et al*., 2010; Saed *et al*., 2024; Ahmad, 2025).

Given the scale of the problem, there is an urgent need to assess Mycoplasma infection prevalence, risk factors, and clinical patterns in small ruminant populations across different settings (Urie *et al*., 2019; Abed *et al*., 2024; Karupusamy *et al*., 2023). This study aims to investigate Mycoplasma infections in sheep and goats by examining prevalence rates, identifying key risk factors, describing clinical characteristics, and evaluating current control strategies (Chota *et al*., 2019; Al-Aameli *et al*., 2019; Hsu *et al*., 2024). Ultimately, the study seeks to propose sustainable and location-specific control measures that can be shared with veterinary authorities and smallholder farmers to improve herd health, reduce economic losses, and enhance the long-term sustainability of small ruminant production systems.

MATERIALS AND METHODS

Study design

To find the prevalence and assess the management approaches for Mycoplasma infections in small ruminants, especially sheep and goats, there was a cross-sectional survey. The survey was conducted on several farms with intensive, semi-intensive, and extensive animal production systems from June 2024 to November 2024.

Study population and sample size

The survey had a total number of 150 small ruminants, both goats and sheep of different ages, sex, and physiological conditions. Animals were chosen by stratified random sampling for proper representation from diverse farm conditions and herd size.

Clinical examination and sample collection

All animals selected were subjected to a detailed clinical examination for the detection of symptoms indicative of Mycoplasma infection, such as:

- Coughing
- Nasal discharge
- Respiratory distress
- Fever
- Loss of weight or appetite
- Reduced milk production

Post-mortem analyses were carried out in the case of dead and culled animals, with emphasis on lung and thoracic lesions (Egwu *et al*., 2012).

The following samples were obtained:

- Nasal swabs to be cultured and subjected to PCR
- Blood for serological analysis
- Lung tissue (from decaying animals) for culture studies and histopathology

The samples were aseptically harvested and sent in sterile packaging under refrigeration to the laboratory within 6 hours (Prats-van der Ham *et al*., 2015).

Laboratory diagnosis

- Culture method: Samples were inoculated on Mycoplasma-selective PPLO agar and broth medium (Muheet *et al*., 2020). The plates were incubated at 37°C in the presence of 5% CO_2 for 3–7 days. Microscopic examination was performed for colonies for the distinctive "fried-egg" appearance.
- Polymerase chain reaction (PCR): DNA was obtained using standardized methods. Species-specific primers were used to detect Mycoplasma ovipneumoniae and Mycoplasma agalactiae. The products of PCR were visualized on 1.5% ethidium bromide-stained agarose

gel electrophoresis (Maksimović *et al*., 2022).

Risk factor assessment

A set questionnaire was completed by 30 farmers dealing in livestock in order to get data on their management practices. Questions ranged from the housing and ventilation of animals to stocking densities and animal movements, cleaning cycles, quarantine processes for new arrivals, the administration of antibiotics, and vaccination schedules (Maksimovic *et al*., 2013). These answers were verified from actual observation upon visits to farms.

Assessment of control measures

The survey assessed the control practices implemented in each farm (Dudek *et al*., 2020). This included considering hygiene practices, vaccination protocols, antibiotic regimens, quarantine for new animals brought into the farm, veterinary services, and farmer training programs. The farms were thus grouped based on whether or not these tactics were being utilized, to see how they influenced lowering infection rates.

RESULTS AND DISCUSSION

This section presents a thorough explanation of the findings from clinical examinations, lab diagnosis, farmer questionnaires, and observations. The results indicate prevalence of Mycoplasma infection in small ruminants, associated clinical manifestations, risk factors, and effectiveness of control measures. The discussion interprets these findings against a background of available literature and field practice with the aim of providing valuable information for better disease management and control.

Prevalence of mycoplasma infections

A prevalence study involving 150 animals was used to establish the Mycoplasma infection prevalence in small ruminants (Windsor, 2022). The aim of the research was to establish the overall infection burden as well as demographic and species trends.

Table 1: Prevalence of mycoplasma species in small ruminants.

Infection status	Number of animals	Percentage (%)
Mycoplasma ovipneumoniae	26	17.3
Mycoplasma agalactiae	17	11.3
Total positive cases	43	28.7
Total negative cases	107	71.3

Out of 150 tested animals for Mycoplasma infections Table 1 revealed 43 positive results which yielded an overall prevalence rate of 28.7%. Among the pathogens identified *Mycoplasma ovipneumoniae* appeared most frequently at 17.3% whereas *Mycoplasma agalactiae* registered at 11.3%. The infection rates showed goats had higher prevalence (31.4%) than sheep (26.0%) and young animals less than one year old experienced more severe infection (Ait Lbacha *et al*., 2017). The research area shows extensive Mycoplasma infection rates whose distribution depends on the species and age group of animals potentially due to variations in their immune systems and their management practices.

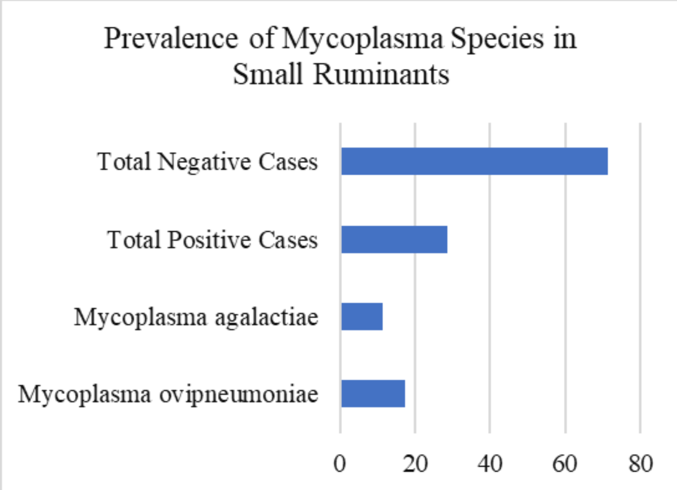

Figure 1: Prevalence of mycoplasma species in small ruminants.

Clinical features and post-mortem findings

A thorough analysis of clinical signs and post-mortem examination was conducted to describe the clinical manifestations of Mycoplasma infection in small ruminants (Paul *et al*., 2021). The evaluation offers information on typical signs in infected animals and pathological alterations confirming clinical diagnosis.

Table 2: Frequency of clinical signs observed in infected animals.

Clinical sign	Number of affected animals	Percentage (%)
Coughing	35	81.3
Nasal discharge	32	74.4
Respiratory distress	29	67.4
Fever	24	55.8
Decreased milk yield	18	41.9
Loss of appetite/weight	21	48.8

Table 2 emphasizes the fact that the respiratory symptoms prevailed among the affected animals, including coughing (81.3%), nasal discharge (74.4%), and respiratory distress (67.4%) as most common signs observed. Fever (55.8%) and loss of weight or appetite (48.8%) were also impressive, reflecting involvement at the systemic level (Santos *et al*., 2018). The infection's productivity impact was indicated by 41.9% of animals manifesting a drop-in milk production.

Post-mortem findings further supported these results by identifying characteristic lung lesions including consolidation, pleuritis, and serofibrinous exudate in severely infected goats (Heidari *et al.*, 2018). These pathological and clinical findings together emphasize the respiratory-focused nature of Mycoplasma infections and their considerable contribution to animal well-being and farm productivity.

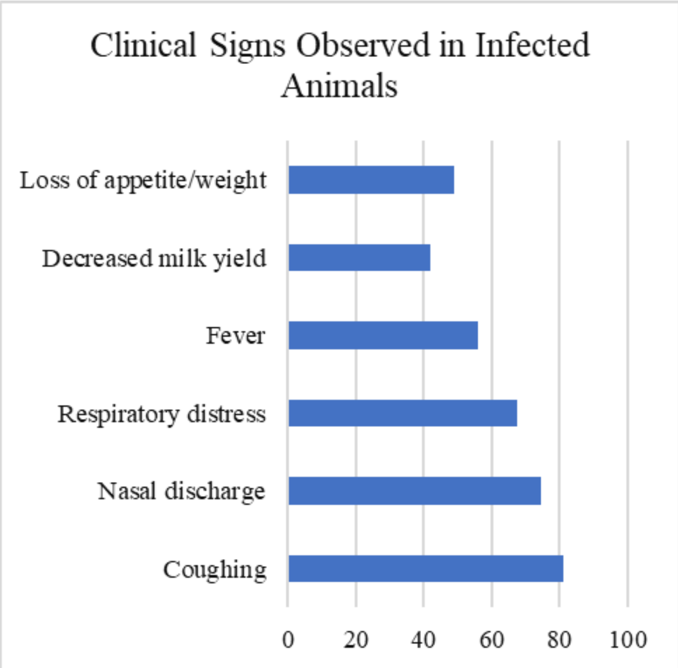

Figure 2: Percentage of clinical signs observed in infected animals.

Risk factor assessment

Knowledge of the inherent risk factors responsible for the transmission of Mycoplasma infections in small ruminants is crucial for the development of effective preventive methods (Stuen, 2020). The following Table 3 highlights prominent risk factors detected through farmer questionnaires and field observations, along with their correlation with infection levels.

Table 3: Association of risk factors with mycoplasma infection rate.

Risk factor	Farm % (Reported)	Infection association
Poor ventilation	73%	Strong
Overcrowding	68%	Strong
No quarantine for new animals	61%	Strong
Inadequate sanitation	65%	Moderate
Shared feeding/watering points	79%	Strong

Table 3 indicates that a number of environmental and management practices are highly associated with increased Mycoplasma infection levels (Poumarat *et al.*, 2014). Poor ventilation (73%), overcrowding (68%), and the lack of quarantine procedures for new animals (61%) were all strongly associated with infection. Furthermore, 79% of farms had shared feeding and watering points, another practice highly associated with disease spread. Insufficient sanitation, as indicated by 65% of the farms, had a moderate correlation with infections. These results highlight that poor biosecurity, suboptimal infrastructure, and inefficient herd management are key risk indicators leading to the high prevalence of Mycoplasma infections among the population under study.

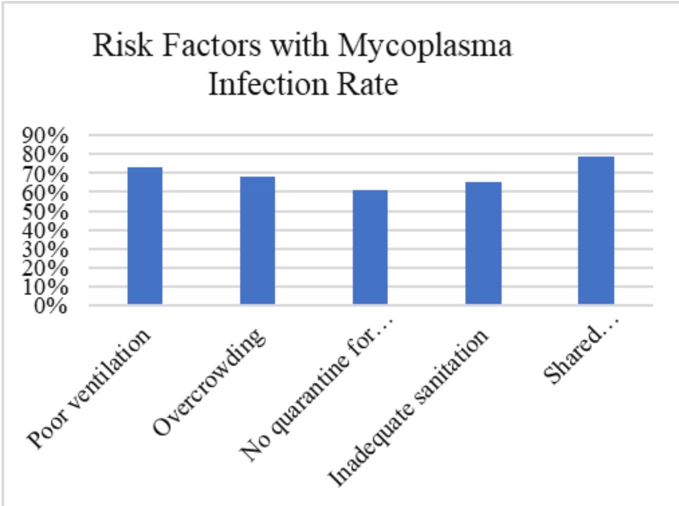

Figure 3: Association of risk factors with mycoplasma infection rate.

Effectiveness of control measures

Successful management of Mycoplasma infections in small ruminants relies on the application of holistic herd health management practices (Jaÿ *et al.*, 2021). This analysis examines the impact of varying combinations of control strategies on infection incidence to identify the significance of integrated approaches to preventing disease on farms.

Table 4: Impact of control measures on infection prevalence

Control measures implemented	Number of farms	Avg. infection rate (%)
Vaccination + Hygiene + Quarantine + Vet visit	10	13.2
Only hygiene and vet visit	8	21.7
No consistent measures	12	39.8

Table 4 illustrates a strong negative correlation between the level of control measures taken and the mean infection rate (Chakraborty *et al.*, 2014). The farms that practiced a comprehensive method integrating vaccination, hygiene measures, quarantine procedures, and frequent veterinary consultations had the lowest infection rate of 13.2%. Those that applied only hygiene procedures and veterinary assistance had a comparatively higher infection rate of 21.7%. Conversely, farms with no regular control measures had the highest incidence, with an average of 39.8%

(Chota, 2021). This trend clearly indicates that integrated, multi-pronged control measures are much more effective in reducing Mycoplasma infections than single or irregular measures.

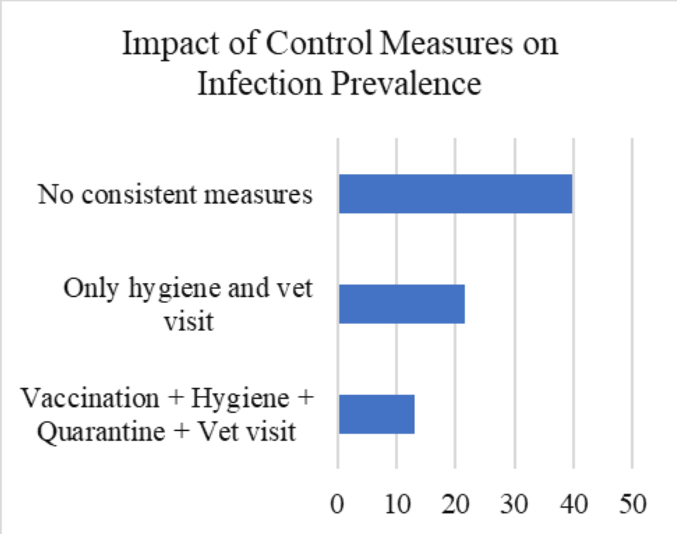

Figure 4: Impact of control measures on infection prevalence.

Farmer education and veterinary assistance

Farmer training and availability of veterinary care were also measured. Most farmers who adopted control practices indicated they received some type of veterinary advice or training.

Table 5: Role of farmer training and veterinary support.

Parameters	% Farms reporting	Infection trend
Trained farmers on disease control	56%	Lower prevalence
Regular vet visits	68%	Lower prevalence
No formal guidance	32%	Higher prevalence

The figures given in Table 5 are clear to show that farmer training and continuous veterinary assistance have a great bearing on Mycoplasma infection prevalence among small ruminants. Those farms where farmers were trained in disease control had a much lower infection rate, indicating that well-informed livestock management practices immediately lead to improved animal health (Parker *et al.*, 2018). Concomitantly, 68% of farms that had regular veterinary visits showed declining infection levels, underlining the importance of professional veterinary management in early diagnosis, treatment, and prevention. The infection rates at farms without formal guidance (32%) kept growing which proves the essential role of standard farmer education programs and regular veterinary support (Hampel *et al.*, 2014). Effective Mycoplasma infection control depends heavily on farmer education programs and veterinary service accessibility according to this reading.

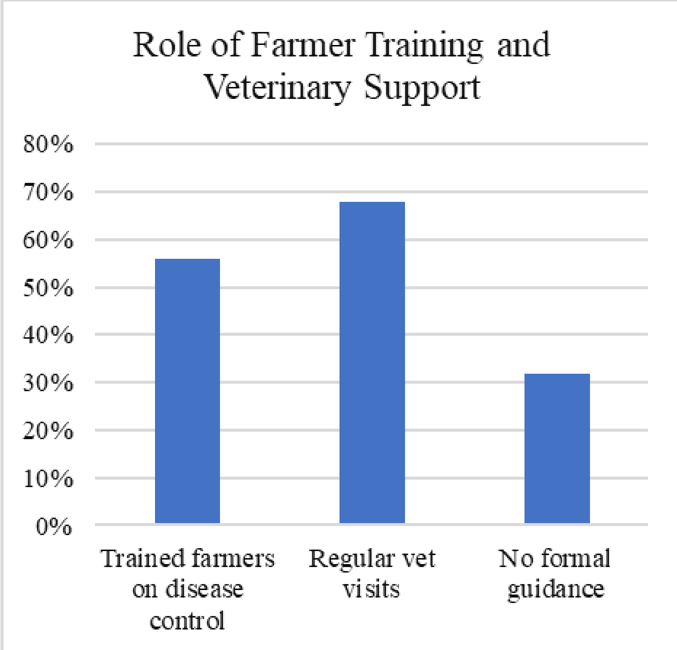

Figure 5: Role of farmer training and veterinary support.

CONCLUSIONS AND RECOMMENDATIONS

The study confirms Mycoplasma infections persist as widespread and financially important health issues affecting young animals and goats among small ruminants. The study confirms that inadequate ventilation along with overcrowded conditions without quarantine measures and unhygienic conditions directly lead to higher infection rates. Strong infection control emerges from early vaccination programs which combine with rigorous hygiene protocols and periodic veterinary help and suitable farmer training programs. Livestock farmers need to put in place detailed biosecurity plans and management techniques as preventive measures. The authorities need to support farmer training programs while providing easy veterinary access and encouraging regular diagnostic tool usage through PCR for early disease detection. A successful approach to control Mycoplasma infections in small ruminant populations needs surveillance combined with education and preventive veterinary management strategies.

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NOVELTY STATEMENT

This work is a new and integrated strategy by the assessment at once of both the prevalence and the efficacy of control measures of Mycoplasma infection in small ruminants across varied farm management systems. Other studies have tended to look at either epidemiology or diagnostics at once. This work combines molecular diagnostics (PCR), clinical and post-mortem diagnoses, and risk factor analysis with farmer practices and veterinary behavior. The integration of farmer perception, veterinary care, and farm-level interventions in terms of infection rate is a complete representation of disease dynamics. The diverse analysis fills the gap between lab diagnosis and realistic farm-level control of diseases, adding new knowledge to small ruminant disease management.

AUTHOR'S CONTRIBUTION

All of the trials were designed by Ranya Sami Nadhim, Zuhair I. Al-Mashhadani and Shaymaa Allawy Obead. Zahraa A. Al-Ameri, Zeid Alsadoon and Hasanain A.J. Gharban conducted all of the tests, gathered the data, and composed the manuscript draft. Abdul-Kareem Nasir and Maha Marouf helped with the data analysis that was done to prepare the work for submission to the journal. The final draft of the work was reviewed and approved by all authors for publication in the Journal of Animal and Health Production.

Ethical consideration

Not applicable.

Conflict of interest

The authors have declared no conflict of interest.

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