Contagious caprine pleuropneumonia and *Mannheimia haemolytica*-associated acute respiratory disease of goats and sheep in Afar Region, Ethiopia


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Summary

In April 2002, an investigation into an outbreak of acute respiratory disease in goats and sheep in Milae (Afar), Ethiopia was conducted. The investigation involved 4 flocks (722 sheep and 750 goats in total) and comprised the disease history, clinical and post-mortem examination, and microbiological analysis of nasal swabs, lung lesions, and pleural fluid samples. Clinically diseased animals exhibited severe respiratory distress, and necropsy of two of the goats demonstrated fibrinous pneumonia, lung sequestra, and excessive accumulation of straw coloured fluid in the thoracic cavity. *Mannheimia haemolytica* biotype T was isolated from nine (six goats and three sheep) out of 23 nasal swabs (39.1%). In the two necropsied animals *Mycoplasma capricolum subsp. capripneumoniae* (Mccp) was isolated from the lungs, and *Mannheimia haemolytica* biotype T was isolated from lung lesions and thoracic fluid. An unidentified *Mycoplasma* species was isolated from the thoracic fluid of one of the goats. *Pseudomonas aeruginosa* was isolated from a lung sequestrum of one of the necropsied goats. *In vitro* antimicrobial susceptibility test results indicated that two (33.3%) of the six *M. haemolytica* isolates that were tested were resistant to ampicillin and penicillin G, three (50%) to tetracycline, four (66.7%) to oxacillin, five (83.3%) to erythromycin, and six (100%) to clindamycin. *Pseudomonas aeruginosa* was resistant to all of the different classes of antimicrobials that were tested. Pleuropneumonia caused by Mccp, and secondary complications caused by *M. haemolytica* and the other unidentified *Mycoplasma* species, were confirmed as the cause of the outbreak. Morbidity was not associated with the species of animals affected (P > 0.05); however, mortality was significantly higher in goats than sheep (P < 0.05).

Keywords

Introduction

Small ruminants in Africa represent 21% of the world’s small ruminant population. The population of sheep in Africa represents 17% of the total world sheep population, while goats represent 30% of the world goat population (9). Ethiopia possesses an estimated 11,438,200 and 9,620,800 heads of sheep and goats, respectively (6), equivalent to 2,105,900 tropical livestock units (TLU) (1 TLU = 250 kg; 1 sheep/goat = 0.1 TLU). Small ruminants in Africa are reared in different livestock production systems ranging from crop/livestock mixed systems in the highlands, to pastoral systems in the arid lowlands. Sheep and goats play a significant role in the nation’s economy. Meat and milk are major sources of protein, and hides, live animals, and carcasses account for a significant proportion of exports. In Ethiopia, sheep and goats are affected by many infectious and parasitic diseases. Infectious diseases of small ruminants such as peste des petits ruminants (PPR) (10), sheep and goat pox, contagious caprine pleuropneumonia (CCPP) (7, 10, 19, 21, 27), brucellosis, pneumonic pasteurellosis/manheimiosis and maedi-visna (2) have been reported. Considerable losses occur frequently as a result of outbreaks of such infectious diseases; however, both the outbreaks and losses from such outbreaks are not well documented. Diseases caused by parasites such as *Fasciola*, lungworms, *Haemonchus* and mange mites also hinder the full production potential of these resources.

The classical *Mycoplasma mycoides* cluster contains *M. capricolum* subsp. *capripneumoniae* (Mccp), *M. capricolum* subsp. *capricolum*, *M. mycoides* subsp. *capii*, *M. mycoides* subsp. *mycoides* type SC (MmmLC), *M. mycoides* subsp. *mycoides* type SC, and *Mycoplasma sp*. bovine serogroup 7 (19). Many *Mycoplasma* species are capable of infecting goat and sheep lungs and inducing pleuropneumonia. Contagious caprine pleuropneumonia is a severe contagious disease of goats caused by Mccp. Unlike true CCPP, which is confined to the thoracic cavity, the disease caused by MmmLC, *M. mycoides* subsp. *capii*, and *M. capricolum* subsp. *capricolum* is characterised by prominent lesions in other organs and/or parts of the body in addition to the thoracic cavity (26). *Mycoplasma capricolum* subsp. *capripneumoniae* was first isolated and shown to cause CCPP in Kenya. It has subsequently been isolated in Sudan, Tunisia, Oman, Turkey, Chad, Uganda, Ethiopia, Niger, Tanzania, Eritrea, and the United Arab Emirates (26). In Ethiopia, CCPP occurs in most of the extensive goat rearing areas, namely, Afar, Borana, Omo Valley, West Gojjam, and in the lowlands of Tigray (21, 27). The first case was reported from Assosa District, Western Ethiopia (21).

In the months of February and March 2002, an outbreak of a contagious acute respiratory disease of sheep and goats occurred in Milae District of Afar Region, Ethiopia. The outbreak generated media attention (23), and in response to the request from regional authorities, the outbreak was investigated. This study describes the findings of the investigation.

Materials and methods

General approach to the investigation

A field investigation was initiated on 2 April 2002 in Milae District. As part of the investigation, the geographical area and the history of the disease were assessed, clinical and post-mortem examinations were carried out, and samples from both live and dead animals were taken for laboratory analysis. Four flocks were clinically examined, and two goats from one of these flocks, both of whom had severe respiratory distress, were provided by the owner for post-mortem examination. The owners of all four flocks were interviewed (individually and in a group) using a checklist based on the format used by the World Organisation for Animal Health (OIE) in their monthly outbreak reports (the list includes elements such as species of animal affected, number of cases and deaths, source of the disease, vaccination history, previous treatment, etc).

Study area

The study area was situated within Milae District of Afar Region. The district is located 135 km east of Kombolcha and about 500 km north-east of Addis Ababa along the road to Djibouti. The outbreak area was geographically positioned at 11°24'476"N and 040°45'439"E at an altitude of 703 metres above sea level (Fig. 1). The region is within an arid agro-ecological zone and is prone to recurrent drought due to erratic rainfall. Multi-species pastoralism is the preferred and most practiced system of livestock production. Local breeds of goats and sheep are relatively resistant to the harsh conditions of the area. They serve as a source of milk and meat for the local households and live animals are sold to generate cash whenever the need arises. The district has an estimated 140,976 goats and 70,488 sheep (Afar Bureau of Agriculture, personal communication). Small ruminants are herded and housed separately from other species of animals.

Samples collected

Samples collected from live animals (nasal swabs, serum, and whole blood) and from the two necropsied goats (lung lesions, pleural fluid, and tracheal swabs) were placed in sterile bottles. Eye swabs were also collected from animals showing signs of keratoconjunctivitis. Tubes containing tryptone soya broth were immediately inoculated with...
nasal swab specimens for the isolation of *Mannheimia*. All
of the samples were frozen (–20°C) and transported on ice
to the regional government laboratory in Kombolcha
(within a day). In addition, samples of lung lesions and
pleural fluid were transported to a laboratory in Debre Zeit
(within two days) and stored at –20°C until processed.

**Laboratory diagnosis**

**Bacteriological analysis**

Nasal swabs (from 14 live goats and 9 live sheep) and
autopsy samples collected from the necropsied goats were
subjected to conventional bacteriological examination in
the regional laboratory (Kombolcha). Prior to culture, the
samples were enriched via inoculation into tryptone soya
broth (Oxoid, United Kingdom [UK]) and incubation at
37°C. The enriched samples were then used to inoculate
plates of blood and MacConkey agar (Oxoid, UK).

Bacterial growths were subcultured to obtain pure
colonies, which appeared as Gram-negative short rods after
Gram staining. On blood agar, the colony characteristics of
pure cultures were examined and recorded. On MacConkey agar, colony growth and lactose fermentation
properties were observed and recorded. The following
biochemical tests were subsequently performed: oxidase,
catalase, indole, hydrogen sulphide, urease, glucose,
sucrose, salicine, and trehalose. Based on growth
characteristics and the results of the biochemical tests,
isolates were classified and grouped according to genus
and species.

**In vitro antimicrobial susceptibility**

The agar disc diffusion technique using Mueller-Hinton
medium as described by Jorgenson *et al.* (12) was applied
to *Mannheimia* isolates from two lung samples and four
nasal swabs, and to *Pseudomonas* isolated from one lung
sample. *Escherichia coli* 25922 (ATCC) obtained from the
National Health and Nutrition Research Institute was used
as a quality control. Tests were considered to be valid when
results for the reference strain were within the expected
range specified by the Clinical and Laboratory Standards
Institute (CLSI [formerly NCCLS]). Pure colonies of
bacteria were grown in tryptone soya broth. Bacterial
suspensions were prepared by matching the samples to
0.5 McFarland turbidity standards and were then used to
inoculate Mueller-Hinton media. Antimicrobial discs
(ampicillin, penicillin G, oxacillin, erythromycin,
tetracycline, clindamycin, and sulphafurazole; Oxoid, UK)
were distributed on the inoculated plates using an
antimicrobial dispenser and the plates were incubated at
37°C. Results were read after an incubation period of 18 to
24 hours. Interpretation was made using interpretative
standards described by Jorgenson *et al.* (12), which are
based on CLSI performance standards for antimicrobial
susceptibility testing (18). The zone diameter cut-off value

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**Fig. 1**

Map of Ethiopia indicating the outbreak area
provided for Gram-negative bacteria was used to evaluate susceptibility to ampicillin and penicillin, a cut-off value of 14 mm was used to determine susceptibility to oxacillin, and the cut-off value provided for sulphonamides was used to assess susceptibility to sulphafurazole (12).

**Mycoplasma isolation**

Lung and thoracic fluid specimens collected from the two necropsied goats were submitted to the National Veterinary Institute (Debre Zeit, Ethiopia) for Mycoplasma isolation and characterisation. Mycoplasma was isolated using Thiaucourt’s medium, which contained Bacto-PPLO broth without crystal violet (Difco Laboratories), inactivated horse serum, yeast extract, glucose, sodium pyruvate, ampicillin, and thallium acetate. Tissues were homogenised in broth media using a sterile mortar and pestle. The homogenate was then streaked onto agar plates and the seeded agar plates were incubated at 37°C in a CO₂ incubator for 14 days. The plates were checked daily for the appearance of colonies. Pure colonies were selected and biochemical tests for the breakdown of glucose, hydrolysis of arginine, reduction of tetrazolium chloride, phosphatase activity, and arginine hydrolysis were carried out on each isolate. Isolated Mycoplasma colonies were also examined by growth inhibition and dot-blot tests using Mccp monoclonal antibodies (Centre de coopération internationale en recherche agronomique pour le développement - Elevage et médecine vétérinaire tropicale [CIRAD-EMVT]) (26).

**Virus isolation and serology for antibodies to peste des petits ruminants virus**

A portion of the specimens were also submitted for virus isolation to the Virology Laboratory at the National Veterinary Institute. Eighty-seven samples of sera were sent to the National Animal Health Research Center in Sebeta, Ethiopia, where they were tested for PPR using a competitive enzyme-linked immunosorbent assay (cELISA).

**Statistical analysis**

Data were presented using descriptive statistics and the Chi square test was used to test the null hypothesis of equality of clinical cases and deaths, resulting from the disease, between goats and sheep.

**Results**

**Disease history**

The outbreak was first reported in February. Herdsmen claimed the disease was associated with a shortage of feed due to the long dry season. Both goats and sheep were affected in each of the flocks. The disease covered a large geographical area, indicating a high transmission rate. The flocks were not vaccinated for CCPP and clinically ill animals and suspected cases had been treated with oxytetracycline, which seemed to reduce morbidity and mortality (although the survey team was unable to observe the animals for an extended period of time).

More than 30,000 animals were at risk. Out of a total of 722 sheep and 750 goats from four flocks, the morbidity rate was 57% and 53% and the mortality rate was 22% and 32% in sheep and goats, respectively. At the time that the present investigation was undertaken, the case fatality rate had reached 38% in the sheep population and 59% in the goat population.

**Clinical signs**

Both species developed the disease, though clinical signs were more severe in goats. Fever, loss of appetite and condition, hyperpnoea, expiratory grunt, mucoid nasal discharge, and open-mouth breathing were observed in clinically sick animals (Fig. 2). In one flock, a few of the animals had keratoconjunctivitis with corneal opacity and four of the animals had diarrhoea.

**Fig. 2**

Nasal discharge and mouth breathing due to respiratory distress
**Post-mortem findings**

Necropsy examinations were performed on two goats provided by the owner of one of the flocks. Inspection was concentrated on the thoracic cavity. Lesions were mainly localised in one lung in both of the animals; the gross pathological observations were as follows: excess straw coloured fluid in the thoracic cavity, a red area of consolidation, slightly distended intralobular septa, pleural adhesion, and two encapsulated foci containing whitish material (sequestra) (Figs 3a to 3d).

**Bacteriological analysis**

Bacterial isolates were identified from the various samples based on growth characteristics, Gram staining, and primary and secondary biochemical test results.

**Nasal swab**

Using a variety of different biochemical tests the following results were obtained: 9 of the 23 nasal swabs (39.1%) were positive for *Mannheimia haemolytica* biotype.
T (six from goats and three from sheep), 5 failed to be positive for *M. haemolytica* due to the results of one of the biochemical tests, and 9 (39.1%) were positive for *Bacillus* species.

**Lung**

*Mannheimia haemolytica* biotype T was isolated from lung lesions from both of the necropsied goats. *Pseudomonas aeruginosa* was isolated from lung sequestra and exhibited the following characteristics: growth on MacConkey agar, lactose fermentation negative, oxidase positive, indol doubtful, and glucose, sucrose, and salicine positive. *Pseudomonas aeruginosa* colonies produced a blue pigment on Mueller-Hinton agar and appeared red in colour in brilliant green agar.

**Pleural fluid**

*Mannheimia haemolytica* biotype T was isolated from pleural fluid collected from the two necropsied goats.

**Tracheal swab**

*Bacillus* species were isolated from tracheal swabs collected from the necropsied goats.

**Eye swab**

*Staphylococcus* and *Bacillus* species were isolated from eye swabs taken from animals showing signs of keratoconjunctivitis.

**In vitro antimicrobial susceptibility**

*Mannheimia* isolated from two lung and four nasal swab samples, and *Pseudomonas* isolated from one lung sample, were used for *in vitro* antimicrobial susceptibility tests. The results are presented in Table I.

**Mycoplasma investigation**

*Mycoplasma* was isolated from lung lesions and thoracic fluid collected from the two necropsied goats. After cloning and subculture, three isolates (two from the lung and one from the pleural fluid) were further identified to the species level using biochemical tests and growth inhibition and dot-blot tests specific for Mccp. The isolates were positive for glucose fermentation and reduction of tetrazolium chloride, negative for phosphatase activity, and negative for the hydrolysis of arginine. Two of the isolates (from the lungs of both of the goats) were inhibited with Mccp hyperimmune serum and were positive for the dot-blot test, while the isolate from the pleural fluid of one of the goats was not inhibited by Mccp hyperimmune serum and was negative for the dot-blot test. Hence, from one of the goats, only Mccp was isolated, while from the other goat, Mccp was isolated from the lung and another *Mycoplasma*, which could not be identified, was isolated from the pleural fluid.

**Virus isolation and peste des petits ruminants serology**

No viruses were isolated and one animal was sero-reactive for PPR using the cELISA test.

**Discussion**

Based on clinical, necropsy, laboratory, and epidemiological findings, clinical disease was diagnosed as CCPP, which is caused primarily by Mccp with secondary invasion by *M. haemolytica* biotype T and *P. aeruginosa*. *Mycoplasma capricolum* subsp. *capripneumoniae* was isolated from lung lesions of both of the necropsied goats; however, the species of *Mycoplasma* isolated from the

### Table I

<table>
<thead>
<tr>
<th>Antimicrobials</th>
<th><em>Mannheimia haemolytica</em></th>
<th><em>Pseudomonas aeruginosa</em></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Susceptible no. of isolates (%)</td>
<td>Intermediate no. of isolates (%)</td>
</tr>
<tr>
<td>Ampicillin (10 μg)</td>
<td>4 (66.7)</td>
<td>1 (16.7)</td>
</tr>
<tr>
<td>Penicillin G (10 IU)</td>
<td>3 (50)</td>
<td>1 (16.7)</td>
</tr>
<tr>
<td>Oxacillin (1 μg)</td>
<td>2 (33.3)</td>
<td>1 (16.7)</td>
</tr>
<tr>
<td>Erythromycin (15 μg)</td>
<td>2 (33.3)</td>
<td>1 (16.7)</td>
</tr>
<tr>
<td>Tetracycline (30 μg)</td>
<td>4 (66.7)</td>
<td>1 (16.7)</td>
</tr>
<tr>
<td>Sulphafurazole (100 μg)</td>
<td>2 (33.3)</td>
<td>1 (16.7)</td>
</tr>
<tr>
<td>Clindamycin (2 μg)</td>
<td>6 (100)</td>
<td></td>
</tr>
</tbody>
</table>
pleural fluid of one of the goats could not be identified. Small ruminant respiratory disease often has a multifactorial origin (4), which may have been the case in this outbreak. Mycoplasma capricolum subsp. capripneumoniae caused the primary infection, at least in the goat population. Clinical disease may have occurred as a result of a new infection or may have been the result of a flare-up of subclinical infection stimulated by environmental stress. During the outbreak period, the weather conditions were harsh (extreme ambient temperature) and there was a severe feed shortage. Primary infection of the lower respiratory tract with Mycoplasma and Bordetella parapertussis can increase the susceptibility of sheep and goats to secondary M. haemolytica infection (4). Stress, induced by factors such as heat, overcrowding, exposure to harsh weather conditions, poor ventilation, handling, and transport, is a major predisposing factor (4).

Gross pathological observations were consistent with CCPP; however, the sequestra which were observed on necropsy are not a common characteristic of CCPP. Kusiluka et al. demonstrated the concurrent presence of sequestra and M. capripneumoniae and M. mycoides subsp. mycoides in an outbreak of CCPP in Tanzania (14). Wesonga et al. reported chronic pleuropneumonia with sequestra formations on necropsy at days 82 and 126 post-infection in goats experimentally infected with Mccp (25).

The present outbreak involved both sheep and goats; however, classical CCPP is described only in goats. A possible explanation for the occurrence in sheep in this outbreak is the presence of another pathogenic Mycoplasma which was capable of causing disease in both species of animals (11, 22). Most of such Mycoplasma organisms produce mastitis, arthritis, keratitis, pneumonia, and septicaemia, which present as single conditions or in combination (1, 22, 26). In this particular outbreak the pneumonic conditions were predominant, though animals in one of the flocks also exhibited keratitis and diarrhoea. The presence of lesions in other parts of the body (a characteristic of disease caused by members of the M. mycoides cluster other than Mccp) may have been overlooked during necropsies and clinical examinations, which were concentrated on the thoracic cavity. The number of cases of the disease (morbidity) had no association with the species of animal (P > 0.05), while the severity of the disease (mortality) was significantly higher in goats than sheep (P < 0.05). Absence of post-mortem examination, bacteriology analyses, and specific investigation for Mycoplasma in the lungs of the sheep made it very difficult to determine the primary cause of infection in sheep. However, it should be noted that Mccp and antibodies to Mccp have been reported in pneumonic sheep in outbreaks of CCPP (3, 8), and, therefore, Mccp could be the primary cause of disease seen in sheep in this outbreak.

Pneumonia in sheep and goats, primarily caused by Mycoplasma, is commonly complicated by Pasteurella/Mannheimia (4), which was observed in this outbreak. The Mannheimia species/biotype isolated in upper respiratory tract (nasal swab) and lower respiratory tract (lung and pleural fluid) samples was M. haemolytica biotype T. Isolates from both anatomic sites showed a similar antimicrobial susceptibility pattern. In a study undertaken in calves with clinical signs of respiratory disease, M. haemolytica and P. multocida isolates obtained from nasal and transtracheal swabs showed similar ribotyping and antibiotic susceptibility patterns (5). The investigation suggested that a nasal swab culture can be predictive of bacterial pathogens within the lung and could be used to determine antibiotic susceptibility when the isolates are from acutely ill animals (5). A study undertaken in the highlands of Ethiopia suggested that cases of pneumonic pasteurellosis were mainly caused by M. haemolytica species (unpublished data, F. Kebede and G. Shiferaw).

In vitro antimicrobial susceptibility test results could be used as preliminary information for further monitoring. Most interpretive criteria used to categorise veterinary pathogens as susceptible or resistant to antimicrobials in vitro are based on data obtained from human pathogens and pharmacokinetics of drugs used in humans (20). The validity of these criteria when used in animal pathogens is questionable (24). From the six M. haemolytica isolates tested, all were resistant to clindamycin. Fifty percent of the isolates were resistant to tetracycline and 33.3% were resistant to penicillin and ampicillin, which is indicative of a serious condition. Tetracycline (oxytetracycline) is a common and widely used antimicrobial for treatment of pneumonia as well as other infectious diseases in small ruminants and other farm animals. Penicillin is the most commonly available antimicrobial in Ethiopia and is the front-line drug for treatment of infectious disease in all species of livestock. Pseudomonas aeruginosa was isolated from lung sequestra from one of the necropsied goats and was found to be resistant to the spectrum of antimicrobials tested. Pseudomonas is an opportunistic organism and most infections with this organism have been localised to the respiratory tract and occur in patients with underlying pulmonary disease (13, 17). Pseudomonas is considered to be a true pathogen when it is isolated from a sterile site (13), and in this particular outbreak was not considered to be an important pathogen because it was isolated from a lung lesion of only one goat. Had the isolated Pseudomonas been classified as a significant pathogen, treatment of the infection could have been potentially frustrating since the bacterium is typically resistant to multiple classes of antimicrobial agents (13, 17), which was demonstrated by the in vitro susceptibility results in this study. In addition, susceptible organisms can become resistant during therapy.
due to the production of antibiotic inactivating enzymes (e.g. $\beta$-lactamases), or through mutations in the genes coding the outer membrane pore proteins, or by the transfer of plasmid-mediated resistance from a resistant organism to a susceptible one (17).

This study indicated the emergence of strains of animal pathogens resistant to commonly used antimicrobials. Further investigation on the clinical efficacy of antimicrobials and the impact of emerging resistant strains of animal pathogens on human health is required.

The interaction of a number of factors can predispose animals to acute respiratory disease. The reduction of stressful conditions (e.g. provision of supplementary feed during periods of drought) and the immunisation of flocks against endemic diseases associated with the respiratory disease complex (CCPP, PPR, parainfluenza, and $M. haemolytica$) are important elements of any preventive herd health programme. The primary method of containing the outbreak was the mass treatment of infected flocks using antimicrobials (oxytetracycline), which helped to reduce morbidity and mortality. Although alternative options to reduce the mortality of the flocks were unavailable, caution should be exercised in the mass application of antimicrobials as there is a risk of creating a pool of carriers and/or selecting resistant pathogens. Pastoralists need to be encouraged and supported to apply self-imposed quarantine measures. An early detection, early warning, and early reaction system, which requires the involvement of stock owners and veterinary personnel and authority at various levels, has to be implemented to control endemic diseases in these areas.

This study demonstrated the presence of Mccp and $M. haemolytica$ in a single outbreak in which both goats and sheep were clinically affected, indicating the necessity for strong surveillance based on laboratory isolation and identification of infectious organisms. There is a need for the development and standardisation of rapid, inexpensive diagnostic tests for primary screening in the field prior to confirmatory laboratory diagnosis as part of surveillance and control programmes. Promising experimental results have been reported using latex agglutination tests (capsular polysaccharide antigen and antibody detection tests) (15, 16).

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Pleuropneumonie contagieuse caprine et maladie respiratoire aiguë associée à $Mannheimia haemolytica$ des ovins et des caprins dans la région d’Afar, Ethiopie

G. Shiferaw, S. Tariku, G. Ayelet & Z. Abebe

Résumé

En avril 2002, une enquête a porté sur un foyer de maladie respiratoire aiguë apparu chez les caprins et les ovins à Milae (Afar), en Ethiopie. Une anamnèse, des examens cliniques et post-mortem, ainsi qu’une analyse microbiologique des écouvillonnages nasaux, des lésions pleurales et des prélèvements de liquide pleural ont été réalisés dans le cadre de l’enquête. Les animaux atteints de signes cliniques de maladie présentaient une détresse respiratoire sévère et l’autopsie de deux des caprins a montré l’existence d’une pneumonie fibrineuse, de séquestres pulmonaires et d’une accumulation excessive de liquide jaune.
Pleuroneumonía contagiosa caprina y enfermedad respiratoria aguda asociada a *Mannheimia haemolytica* en ovejas y cabras de la región de Afar (Etiopía)

G. Shiferaw, S. Tariku, G. Ayelet & Z. Abebe

Resumen

Los autores describen una investigación realizada en abril de 2002 sobre un brote de enfermedad respiratoria aguda que afectó a ovinos y caprinos de la zona de Milae, Afar (Etiopía). Amén de estudiar la historia de la enfermedad, se practicaron exámenes clínicos y post-mortem y análisis microbiológicos de exudados nasales, lesiones pulmonares y muestras de líquido pleural. Los ejemplares clínicamente afectados mostraban graves trastornos respiratorios, y en dos cabras sometidas a necropsia se observó neumonía fibrinosa, secuestro pulmonar y excesiva acumulación en la cavidad torácica de un líquido amarillento. En 9 de los exudados nasales (un 39,1%), 6 de cabra y 3 de oveja, se aisló *Mannheimia haemolytica* T, microorganismo también presente en las lesiones pulmonares y el líquido pleural de las dos cabras objeto de necropsia, en cuyas muestras de pulmón se aisló además *Mycoplasma capricolum* subsp. *capripneumoniae* (Mccp). En el secuestro pulmonar de una de ellas se detectó asimismo la presencia de *Pseudomonas aeruginosa*. Por otro lado, a partir del líquido torácico de una cabra se aisló una especie no identificada...
References


