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ADDIS ABABA UNIVERSITY

COLLEGE OF VETERINARY MEDICINE AND AGRICULTURE

CLINICAL CASE REPORT STUDIES ON SELECTED DISEASES OF VETERINARY IMPORTANCE IN AND AROUND KOMBOLCHA, SOUTH WOLLO, ETHIOPIA

MVSc THESIS

BY

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DEPARTMENT OF CLINICAL STUDIES

MVSc PROGRAM IN VETERINARY CLINICAL MEDICINE

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CLINICAL CASE STUDIES ON SELECTED DISEASES OF VETERINARY IMPORTANCE IN AND AROUND KOMBOLCHA, SOUTH WOLLO, ETHIOPIA

A thesis submitted to the College of Veterinary Medicine and Agriculture of Addis Ababa University in partial fulfilment of the requirements for the degree of Master of Science in Veterinary Clinical Medicine

By

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Department of Clinical Studies MVSc Program in Veterinary Clinical Medicine

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Bishoftu, Ethiopia

Addis Ababa University

College of Veterinary Medicine and Agriculture

CLINICAL CASE STUDIES ON SELECTED DISEASES OF VETERINARY IMPORTANCE IN AND AROUND KOMBOLCHA, SOUTH WOLLO, ETHIOPIA

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Dr. Abdi Feyisa (DVM, MVSc, Assistant Profesor) _____ _____

Thesis advisors Signature Date

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STATEMENT OF AUTHOR

First, I declare that this thesis/dissertation is my bonafide work and that all sources of material used for this thesis have been duly acknowledged. This thesis has been submitted in partial fulfilment of the requirements for an advanced MSc degree at Addis Ababa University, College of Veterinary Medicine and Agriculture and is deposited at the College library to be made available to borrowers under rules of the Library. I solemnly declare that this thesis is not submitted to any other institution anywhere for the award of any academic degree, diploma, or certificate.

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LIST OF ABBREVIATIONS

AAU	Addis Ababa University
BHK	Baby Hamster Kidney
CMT	California Mastitis Test
CSA	Central Statistical Agency
CVMA	College of Veterinary Medicine and Agriculture
ELISA	Enzyme-Linked Immunosorbent Assay
ESH-L	Embryonic Sheep Skin Line
FAO	Food and Agricultural Organization
FMD	Foot and Mouth Disease
FMDV	Foot and Mouth Disease Virus
GDP	Gross Domestic Product
GIT	Gastrointestinal Tract
HF	Holstein Frisian
IKC	Infectious Keratoconjunctivitis
IM	Intramuscular
LSD	Lumpy Skin Disease
LSDV	Lumpy Skin Disease Virus
m.a.s.l.	Meter Above Sea Level
MVSC	Master of Veterinary Science
NSAIDs	None Steroidal Anti-inflammatory Drugs
NVI	National Veterinary Institute
OIE	Office for International Des Epizootics
PCR	Polymerase Chain Reaction
PPR	Peste Des Petits Ruminants
PPRV	Peste Des Petits Ruminants Virus
SC	Subcutaneous
SGP	Sheep and Goat Pox
VTM	Viral Transport Media

ABSTRACT

Descriptive designed case study was performed from animals presented to Kombolcha, Dessie, and Harbu City Administration Veterinary Clinics from October 2022 to June 2023. The study was conducted with the purpose of identifying and organizing case reports of individual patient animals. Accordingly, different clinical cases of infectious and non infectious diseases and their therapeutic management in different species of animals with different breed, age, sex, and physiological parameters were examined. The method of clinical examination involves owner compliant, physical and general examination and then tentative diagnosis. Appropriate sample/s was/ were taken from the patient animal and sent to the laboratory to confirm the cases. Animlas were treated and managed using locally available broad spectrum therapeutic agents along with supportive therapy following the manufacturer's instructions. To know the status of recovery, the animals were then well followed either at clinic or at home visit or by phone calling. The final diagnosis was based on the tentative diagnosis, treatment response, and laboratory test results. A total of 19 clinical cases comprised of 39 total animals were compiled during the study period. From the compiled cases, 13 (33%), 20 (51%), 4(10%), 1(3%) and 1(3%), were cattle, sheep and goats, camels, donkey and chickens, respectively. In addition, the result revealed, good prognoses were obtained in 33 (85 %) of the cases, whereas 6 (15 %) animals were died. From the total compiled causes, six (32 %), five (26 %), four (21 %), one (5 %), and three (16 %) were caused by bacteria, viruses, parasites, metabolic issues, and other alignments, respectively. Finally, each case were compiled and placed together using a case report format including a summary, an introduction, a description of the case, tentative and definitive diagnosis, the results of laboratory test, case management and treatment outcomes, and a discussion for each case. Therefore, study gives suggestion about recognition of the commonly found cases of veterinary importance in the study area. In addition, early treatment and uncomplicated cases were having higher chance of recovery. Public awareness and improving veterinary services were recommended for better handling of clinical cases of animals in the study area.

Key words: *Animals, Case Study, Clinical Examination, Disease, Treatment*

1. INTRODUCTION

Livestock in Ethiopia provides drought power, incomings to farming communities, means of investment, and an important source of foreign exchange production for the nation (Birhanu and Nekemt, 2014). Accordingly, cattle produce 0.331 million tonnes of meat annually and a total of 3.2 billion liters of milk from about 10 million milking cows, an average of 1.54 liters per cow per day over a lactation period of about six months (Teshager *et al*., 2013). In addition, the livestock sector provides 16% of the total GDP, which is 30% of agricultural GDP, and generates 14% of the country's foreign exchange (CSA, 2009). However, numerous infectious and non-infectious diseases affect the health of livestock (Beauchemin and Penner, 2009).

The development of the livestock industry is greatly hindered by these diseases in the tropics (Devendra *et al*., 2000), including Ethiopia. Widespread endemic diseases, which include bacterial, viral, and parasitic infections, are the main health factors that limit animals' productivity (Zewdie, 2004). A variety of livestock diseases like contagious bovine pleuropneumonia, lumpy skin disease, foot and mouth disease, Newcastle disease, Peste des petits ruminants, sheep and goat pox, and African horse sickness, are widespread in Ethiopia (Gizaw *et al*., 2020). These diseases cause enormous mortality and morbidity (Birhanu and Nekemt, 2014). In Ethiopia, mortality rates of up to 49% have been recorded for oxen, 50% for native cows, 81% for crossbred cows, 52% for local calves/heifers, and 60% for crossbred calves/heifers (Genbremedhin *et al*., 2017).

Furthermore, the diseases of intensification, which are associated with high-input, high-output market-oriented production and include mastitis, lameness, dystocia, and metabolic diseases, can have an effect on the production and productivity of animals (Perry and Grace, 2009). Therefore, it is likely that the treatment, control, prognosis, and welfare of animals will be optimized by a competent clinical examination and an accurate diagnosis (Abdisa, 2017). Correct diagnosis of disease is the major step between the cause and cure of disease (Ashraf and Imran, 2018).

To make an accurate diagnosis of the disease or other clinical abnormalities, the veterinarian must first conduct a clinical examination, which is a crucial step in the procedure (Abdisa, 2017). However, due to the similarity of clinical presentation, the clinical diagnosis of cattle diseases can be complicated under field conditions (Beyene *et al*., 2017).

Today, many infectious diseases of domestic animals can be successfully prevented or treated (Wobeser, 2007; Perry and Grace, 2009).). Thus, it is vital to be familiar with the disease occurrence pattern to resolve the problems in the local area via clinical records of the disease using appropriate technique (Haftu *et al*., 2014). In light of this, confirming diagnosis by appropriate sample collection and treatment of each individual animal is essential and vital to enhance animal welfare, boost productivity, protect the health of both animals and humans, and satisfy the owners. Additionally, it is expected that the documentation of disease information is utilized as baseline data for additional future research.

1.1. Objectives of the Study

1.1.1. General objective

- To compile and report selected clinical cases of veterinary importance in and around Kombolcha, South Wollo, Ethiopia.

1.1.2. Specific objectives

- To identify the clinical indications of cases of veterinary importance.
- To confirm the causes for clinical cases of animals.
- To produce a compiled document used for further studies.
- To treat clinical cases of animals by the available drug and non- drug medications and recommend those treatment protocols for professionals.
- To investigate the treatment outcome of clinical cases in the study area.

2. MATERIAL AND METHODS

2.1. Study Area

The study was conducted in the open air Veterinary Clinics of Kombolcha, Dessie, and Harbu City Administrations, South Wollo, Ethiopia, from October 2022 to June 2023. The bacteriological and parasitological laboratory works were performed at Kombolcha Animal Disease Survey, Investigation, and Diagnostic Laboratory centre. The areas are found to the north-east of Ethiopia in the South Wollo zone of Amhara regional state. Kombolcha is located about 375 km north-east of Addis Ababa and at a height between 1,500 and 1,840 m.a.s.l. It shares borders with Dessie Zuria and Tewuledere districts in the north, Dessie Zuria and Dessie town in the west, Kalu and Dessie Zuria in the south and Kalu in the east (Abunna *et al*., 2012). The average annual rainfall and temperature are between 750 and 900 and 25 and 30°C, respectively, with relative humidity varying from 23.9 to 79% (Alula *et al*., 2013). The primary grazing areas for animals include swampy and waterlogged areas, forest margins, hilly crop and mountainside areas, stony and infertile lands, and roadsides (Tesfaye *et al*., 2017). There are 22,455 cattle, 9,537 sheep, and 15,310 goats in the animal population (Asmelash *et al*., 2016).

Dessie is a town in north-eastern Ethiopia, 401 kilometres from Addis Ababa, at 11° 08' North latitude and 39° 38' East longitude, and 2600 meters above sea level. The average annual rainfall is 1100–1200 mm. The average lowest and highest temperatures are 12.37°C and 26.27°C, respectively (DFEDB, 2015).

The other site Harbu is one of the city administrative kebels of Kalu woreda. Its climate ranges from semi-arid to dry and sub-humid. The soils, which range from sandy loam to silty loam, are often fertile (Kelemu *et al*., 2014). Harbu is found 360 kilometres to the northeast of Addis Ababa at 10°55°N, 39°46°E, and has a height of 1484 m.a.s.l. It has an average annual rainfall of 1144.80 mm and the lowest and highest temperatures of 13.19°C and 27.65°C, respectively (Beshir *et al*., 2019). In the study area, the farming system is a mixed crop-livestock production type. The main crops grown in include both rain-fed and irrigated crops such as maize, millet, tef, fruits, and vegetables.

2.2. Case Study Design, Methods and Handling Protocols

In this case study report, a descriptive case study design was executed by sampling of animals presented to animal handling facilities and phone call requests with the purpose of identifying and organizing case reports of individual patient animals. Different animal species which includes cattle, goat, sheep, donkey, camel, and chickens with different breeds, ages, sexes, and physiological parameters included in the study. Accordingly, a total of 19 clinical cases comprised of 39 total animals were compiled during the study period. The summary of the species, age, sex, and management system composition of the study animlas is indicated in Annex 8. In each clinical case, the purpose of the study was concisely explained to the owner and informed oral consents were obtained from the owner's before starting history. A thank-you note (verbal) was given to the owners after the end of the recording of the patient's outcome (Annex 1).

The history was obtained from the owner and contain the chief complaint, signalment (age, species, breed, sex), details of present illness, past medical or surgical problems, health maintenance (vaccinations, routine diagnostic testing, treatments), previous and present drug history, diet, environment, herd history, and a general systems review (coughing, sneezing, vomiting, diarrhea, discharges, lameness, appetite, water consumption, urination, weight gain or loss, etc.). Physical and general examinations of the animals were performed and temperature, pulse, respiratory rate, and clinical findings of each sick animal were recorded. The detailed outline of method of clinical examination and case handling protocols is shown in Annex 2. Tentative diagnoses of the cases were performed based on detailed histories, clinical signs, and examinations. After a specific disease condition can be tentatively suspected, appropriate samples from the diseased animals were collected and processed in the laboratory for a definitive diagnosis.

The final diagnosis of the disease was based on the combination of disease history, clinical signs, physical examination, disease epidemiology, and laboratory test results. Then, once the disease was diagnosed, animals were treated and managed using locally available therapeutic agents and supportive drugs based on the manufacturer's guidelines.

The cases were then well followed until recovered, either in the clinic during the successive therapies or at home through telephone conversation with the owner or a house visit to know the status of recovery.

A case record of the information pertaining to an animal or a herd of animals that is suspected of having a disease will begin at the time that the animal is taken to a health facility or during a visit to the animal and continue through treatment. It includes a description of the animal, the owner's report, the animal's history, clinical findings resulting from an examination of body systems, results of specific laboratory tests, a diagnosis regarding a specific cause for the disease, treatment, and case progress. A clinical case recording format (AAU, CVMA) was used for each case (indicated in Annex 3).

3. COMPILED CLINICAL CASE REPORTS

Finally, each case was put together using a case report compilation style following the guidelines for publishing scientific cases. This includes a summary, an introduction, a description of the case, tentative diagnosis, the results of laboratory test, definitive diagnosis, case management and treatment outcomes, and a discussion for each case. An attempt was also made to include images of the animals showing their conditions before and after treatment.

3.1. Compiled Clinical Case Reports on Cattle

3.1.1. Clinical mastitis in cows and doe

Abstract

Mastitis is characterized by inflammation of the mammary gland with physical, chemical, and bacteriological changes in the milk and pathological changes in the udder, which results in significant economic loss worldwide. This case report describes the separate clinical cases of mastitis in yong cow, old cow and a doe and their treatment outcomes in Kombolcha, South Wollo, Ethiopia. The history of the causes indicated reduced milk yield (older cow), complete milk production stopping (young cow) and reduced feed intake, swelling of the udder, and abnormal change in the milk in all of the three causes. In addition, the young cow had been affected by symptoms of an oral lesions and salivation. On physical examinations, signs of systemic illness such as reduced feed intake and rises in body temperature, heart rate, and respiration rate were observed. The udder showed inflammatory signs including heat, swelling and pain up on touch. Physical and bacteriological changes were recorded in the milk samples. Based on the history, observed clinical signs, and laboratory findings, the cases were determined to be clinical mastitis caused by *S. Aureus* (cows) and species of *Streptococcus* (doe). The cases were managed using a combination of broad-spectrum antibiotics, anti-inflammatory agents, Multi-Vitamin, and anti-septic solutions. The owner was also informed to always remind the milking of the affected animals and quarter at the end and to maintain the hygienic status of the barn properly.

The health conditions of both cows showed improvement and the milk resumes to its normal colour on the post treatment period. On one-month post treatment visit, the animals completely recovered with the complete absence of clinical signs. In conclusion, in the current case study cases of clinical mastitis were detected and treated successfully. Therefore early treatment using antibiotics together with anti-inflamatory drugs aided in the recovery of a clinical case of mastitis.

Key words: *Antibiotics, Mastitis,* S. *aureus, Streptococcus*

Introduction

Mastitis is one of the most common diseases of dairy animals that affect the wellbeing of livestock populations (Balemi *et al*., 2021). It is an inflammatory response of the udder tissue in the mammary gland caused by physical infection by microorganisms, trauma, or injury to the udder (Gomes and Henriques, 2016). It is one of the major and most expensive diseases in terms of production losses in dairy production. It severely reduces milk yield, profit margins, and quality of milk and milk products in all dairy-producing countries in the world (Birhanu *et al*., 2017). Moreover, the treatment costs, the discarding of milk with antibiotics, and death from severe inflammation cause considerable economic losses (Balemi *et al*., 2021). In Ethiopia, mastitis is responsible for 78% of losses in milk production (Abera, 2020), mainly due to milk production losses and culling (Mungube *et al*., 2005). This makes mastitis the most costly disease on dairy farms worldwide and a particular issue for farmers in developing countries like Ethiopia (Abebe *et al*., 2016). Consequently, the removal of milk from lactating animals with mastitis causes significant food losses, which in turn results in nutritional insufficiency in children and nursing mothers (Kemp *et al*., 2008).

Alternatively, mastitis can be classified as either clinical or subclinical (Girma and Tamir, 2022) based on the presence or absence of observable manifestations of clinical signs (Belay *et al*., 2022). Subclinical mastitis is characterized by an increased somatic cell count in the milk and the absence of visible clinical signs (Zeryehun and Abera, 2017). Conversely, clinical mastitis is characterized by sudden onset, alterations in milk composition and appearance, decreased milk production, the presence of one or more of

the cardinal signs of inflammation in infected mammary quarters, abnormal milk, and systemic signs such as lethargy, anorexia (Birhanu *et al*., 2017; Belay *et al*., 2022), appetite loss, dehydration, and depression (Schroeder, 2010). Clinical mastitis further poses a hazard to animal welfare since it causes pain, a rise in mean rectal temperature, a rise in heart rate, and a rise in respiration rate (Mekonnen *et al*., 2005).

From about 137 infectious agents known to cause mastitis in large domestic animals, *Staphylococcus*, *Streptococcus*, and coliform bacteria are the most common bacteria that cause mastitis, and *S. aureus* is the leading cause of mastitis (Balemi *et al*., 2021). According to Vasudevan *et al*. (2003), *S. aureus* is the most prevalent pathogen associated with clinical and sub-clinical mastitis. Similarly, *Streptococcus uberis* causes recurrent mastitis and is associated with clinical and sub-clinical infections (Abureema, 2014).

Mastitis is a multifactorial disease involving microbes, the host, and the environment (Girma and Tamir, 2022). Cattle with large funnel-shaped teats or pendular-shaped udders and blind quarters after calving, older cows most probably because of the wider or permanently partially open teat canal as a result of frequent milking, cows in transition, and cows with negative energy balance are at a higher risk of mastitis (Cheng and Han, 2020). Additionally, high stocking density, contaminated floors, wet bedding, poor ventilation, and a hot and humid climate can promote the growth of mastitis pathogens and increase cow exposure to mastitis (Abebe *et al*., 2016). Similarly, lactation stage, parity, history of mastitis, floor type, and teat injury were factors significantly associated with mastitis among dairy cows in Ethiopia (Girma and Tamir, 2022). Thus, improving sanitation such as enhanced milking hygiene, implementation of post-milking teat disinfection, and maintenance of milking machines are general measures to prevent new cases of mastitis (Cheng and Han, 2020).

Control and prevention of such an important disease in the dairy sector require rigorous and systematic research and documentation of information on the status of the disease (Zeryehun and Abera, 2017). Antibiotic infection control is the only method used to treat mastitis, and the intramuscular route is the most important route of administration of antimicrobials (Kausar *et al.*, 2016).

In addition, to reduce the clinical symptoms of the condition and raise animal welfare standards, non-steroidal anti-inflammatory drugs have been encouraged for use as supportive therapy (Mavrogianni *et al*., 2011). Therefore, this case report describes the clinical cases of mastitis in young cow, old cow, and doe and their treatment outcomes.

Case descriptions

Case 1

The history of a three-year-old Holstein-Friesian cross breed young cow was presented to the Kombolcha City Administration Veterinary Clinic on December 29, 2022, from one of the small-holder dairy farms. The primary complaints were reduced feed intake, swelling of the udder, and complete milk production stopping. The cow gave birth before two months and was kept with the other twelve cows intensively. Based on the owner's information, the cow and the other three cows had been affected by a disease with symptoms of an oral lesion and salivation (suspected as foot and mouth disease).

A farm visit was conducted, and the cow was looked at the barn. Upon physical examination, the rectal body temperature was 39.9 ^{O}C, and the respiratory and heart rates were 32 breaths per minute and 98 rates per minute, respectively. The cow had reduced body condition and was soiled with fecal material from the hind limb. There was drooling of saliva from the cow. During examination of the udder, inflammatory signs like heat, swelling and pain up on touch were observed and the nipples were ulcerated. The base of the right hindquarter was also injured. The milk was drawn and examined for the presence of any physical changes. Accordingly, the milk from the left rear quarter was markedly changed and looks turbid and contains clots but no abnormal odour detected. The milk from the other quarter shows normal milk colour (whitish) (Fig. 1C). The udders of all other animals were examined for the presence of udder injury and looked healthy from the outside. The cow was kept in close proximity to other animals. The barn was unclean, rough, and irregular (Fig. 1A).

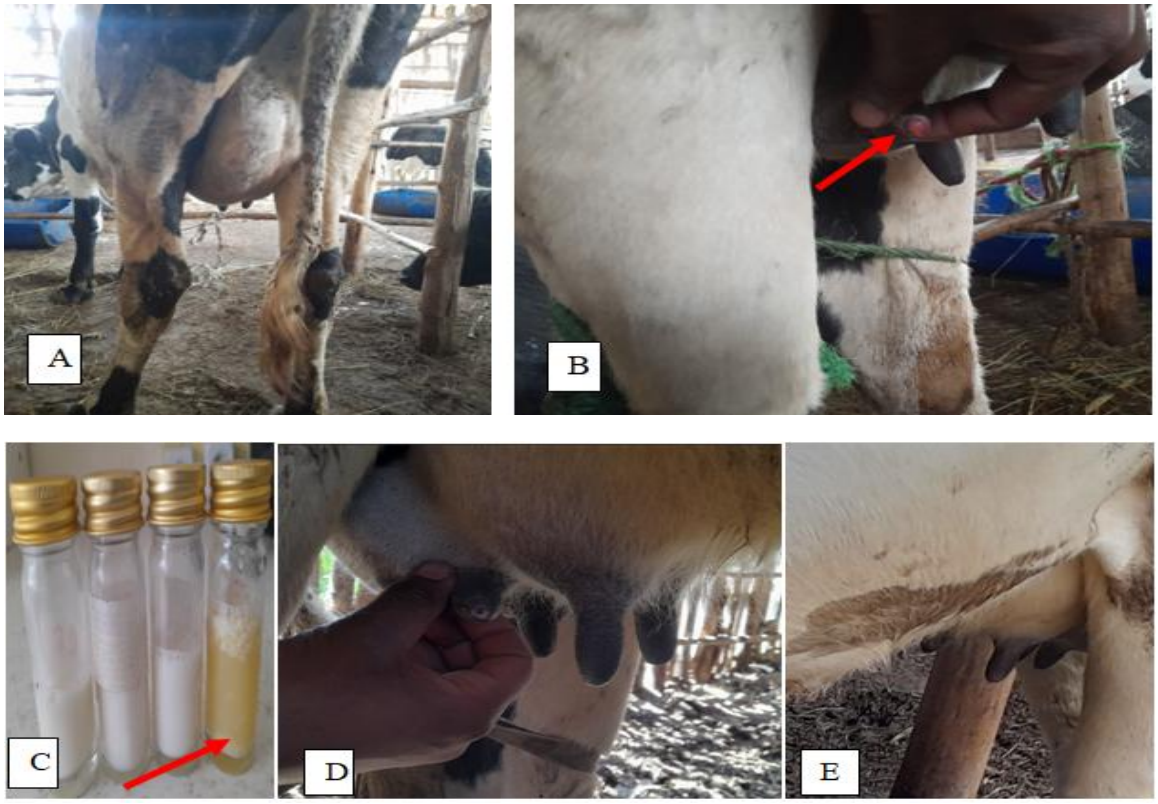

Figure 1: Showing evidence of clinical mastitis in Holstein-Friesian cross breed young cow. Swollen udder and unclean, rough and irregular barn of the heifer (A), teat injury (B), milk from each quarter with turbid and abnormal colored milk from left rear quarter (red arrow) at day one of examination (C) and the condition of the udder and teat at one month later (D and E).

Case 2

The owner presented the history of a fourteen (14) year old cow to the Kombolcha City Administration Veterinary Clinic on January 3, 2023, with the main complaint of reduced milk production and swelling of the udder since one day before. The owner mentioned that the cow gave birth before six months, and the cow suffered from hypocalcaemia many times at parturition. He added that one teat had closed and not been milked since before three years. The cow was kept intensively with other ten cows and one bull. Based on the owner's information, a farm visit was arranged for a physical examination.

During the examination, the rectal body temperature was 40.5 ^{O}C, and the respiratory and heart rates were 20 breaths per minute and 82 beats per minute, respectively.

The cow was alert and had a smooth, shiny coat with normal urination and defecation. On examination of the udder, there was redness and swelling, heat, and a slight firmness to the touch. The left rear teat was blind, and there were minor ulcerative lesions on the right front teat (Fig. 2A). The milk was drawn and examined for the presence of any physical change. The colour of the milk from the right front and rear teats was changed to turbid, but no abnormal odour was detected (Fig. 2B). The barn was rough and irregular. The milk and the health of the udder of other animlas were normal.

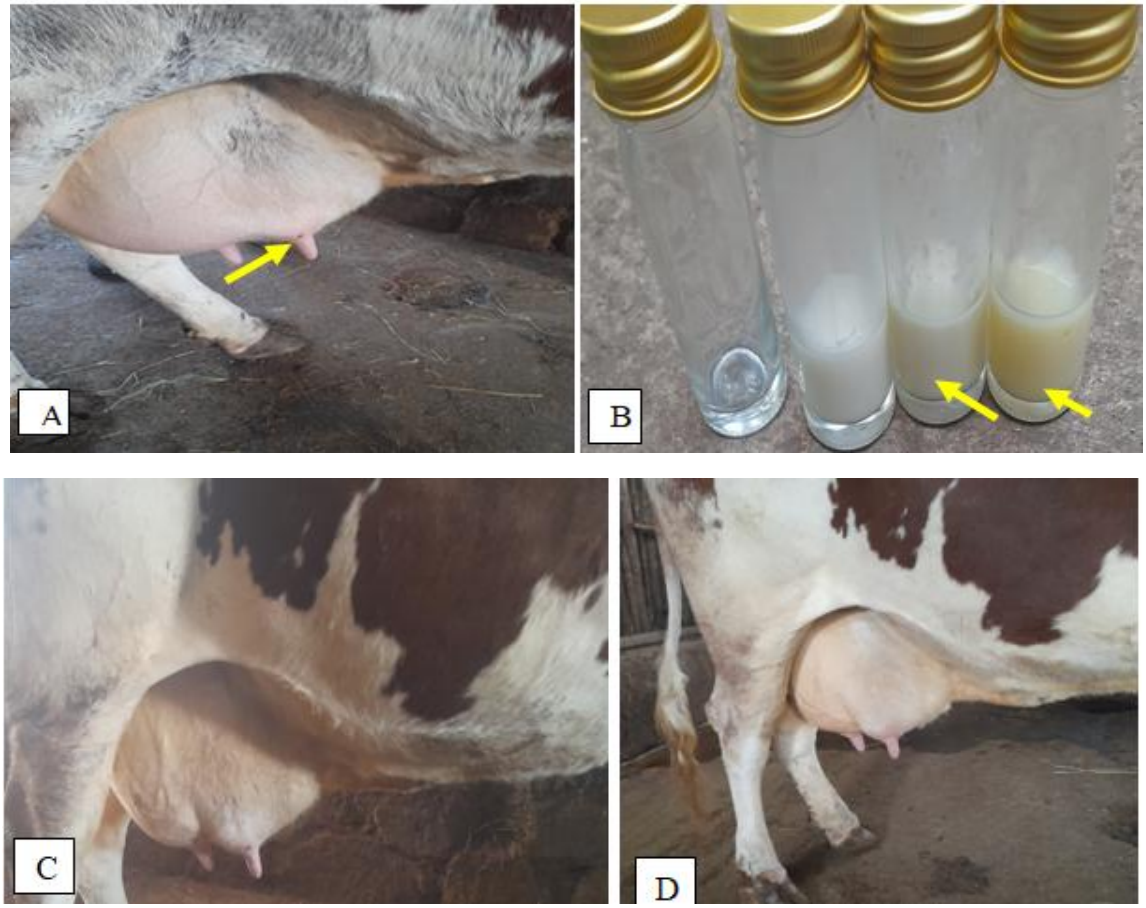

Figure 2: An older cow affected by clinical mastitis before and after treatment. Udder swelling and minor teat injury and rough and irregular barn (A), milk from the three quarter (B) the udder and teat condition at ten days (C) and one month (D) of post treatment.

Case3

The owner presented his doe to Kombolcha City Administration Veterinary Clinic on January 23, 2023 with a complaint of swelling of the udder. He mentioned that the doe gave birth five months earlier. On physical examination, rectal body temperature, heart rate, and respiratory rate were 39.5 ^{O}C, 84 beats per minute and 12 breaths per minute, with slightly reddened conjunctival mucous membranes. On examination, inflammatory sings (swelling of the udder, heat, and pain upon touch) were observed from the left udder. The milk was drawn for examination of the presence of any physical change, and the milk from the left quarter looked slightly turbid in colour and contains clots, but no abnormal odour was detected, while the milk from the other quarter showed typical milk colour. The clinical indications of the case are presented in Figure 3.

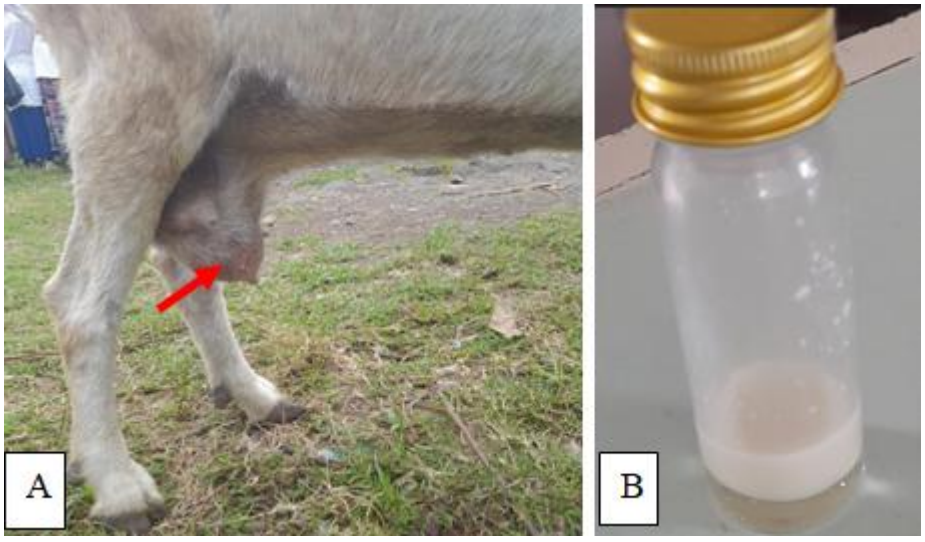

Figure 3: Photograph indicating clinical mastitis in a doe. Swelling of the left udder of a doe (A) and slightly turbid milk with clots (B).

Based on history obtained from the owners and the clinical signs all the three cases were diagnosed as clinical mastitis and milk samples were collected to confirm the causative agent/s.

Sample collection

After the foremilk was discarded, milk samples from each teat (case1 and case 2) and from severely affected teat (case 3) were collected in a screwed bottle. Then, it was transported with cold chain to microbiology laboratory of Kombolcha Animal Disease Survey, Investigation and Diagnostic Laboratory for bacteriological culture and microbiological examination.

Laboratory findings

Around one ml milk sample from each teat, were taken and pooled again in another screwed bottle that form a total of around four ml milk samples (case 1 and 2). Then, for all the three samples a loop of milk sample was inoculated on blood agar and MacConkey plate and incubated at a temperature of 37 ^{O}C for 24 hrs for presence of bacterial growth and colony characterization. Colonies that were golden in colour and with zone of haemolysis (case 1 and 2) and mucoid and haemolytic colonies (case 3) were observed on the blood agar but not on MacConkey agar plate in all the three cases. For further identification and confirmation the colonies were randomly picked and sub cultured again on nutrient agar at 37 ^{O}C for 24hrs to obtain a pure culture. Gram staining, catalase test and growth and fermentation on mannitol salt agar were done from the pure culture on nutrient agar. The procedure is indicated in Annex 5.

On gram staining gram-positive bunch of grape like cocci which is the characteristic of the genus *Staphylococcus* (case 1 and 2) and gram positive cocci, arranged in chain which is the characteristic of the *Streptococcal* species (case 3) were observed. On catalase test bubble was formed within few seconds (case 1case 2). Therefore, the bacterium taken from the nutrient agar was catalase positive but there was no bubble formed (case 3). Therefore, the bacterium taken from the nutrient agar was catalase negative. Colonies (case 1and 2) were sub-cultured on mannitol salt agar plate and incubated aerobically for 24 hrs at 37 ^{O}C. The typical characteristic yellow colonies were grown on mannitol salt agar which is the characteristic of the genus *S. Aureus* (Annex 6).

Based on the history, clinical signs, and laboratory findings, finally the cases were determined to be clinical mastitis caused by the *Staphylococcus* organisms known as *S. aureus* (cases 1 and 2) and *Streptococcus* species (case 3).

Case management and treatment outcome

In all the three cases empirical therapy was arranged using combination of broad spectrum antibiotic, anti inflammatory agents and anti-septic solutions in parallel with sample collection. Accordingly, animals in case one was treated with procaine penicillin G (Heberi Hope Harmony Pharmaceuticals Co. Ltd., China) IM, at 400, 000 units/15 kg per day, once daily for five successive days. Similarly, for animals in case two and three treatment by penstrip (combination of procaine penicillin G and dihydrostreptomycine sulphate), 1 ml/ 20 kg body weight, IM, once daily for five days was arranged. In case one and two, the teats were dipped by iodine daily for seven days. Dexamethasone sodium phosphate injection (Shandong Xier Kangtai Pharmaceutical Co., Ltd.) IM, at 0.2 mg /kg body weight once daily for three days was also arranged as an anti-inflammatory agent for all animals of the three cases. Intramuscular injection of 20 ml Multi-Vitamin (Vietnam) was given to the young cow only. However, after the second dose of medication, the doe interrupts the course of treatment.

In additions, apart from clinical mastitis, the owners were informed well about the likelihood of non clinical mastitis for the other animals from the same barn. The owners were advised to withdrawn the milk for three days after the last treatment. The owner also up to dated always to remind milking of the affected animals and/or quarter at the end and to keep the hygienic status of the barn properly. As she is very old, experience of frequent hypocalcaemia and due to the presence of chronically blind teat the owner in case two was advised to cull the cow. Both the young and older cows gave a good response to the treatment and showed improvement in milk yield. The inflammatory sign reduced from second day and was disappeared and resumed to normal after seven days. The milk resumes into its normal colour in the successive days of treatment. On one month post treatment visit the animals completely recovered with complete absence of clinical signs.

Discussion

Mastitis is a common condition that affects dairy cows and results in significant economic loss worldwide (Halasa *et al*., 2007). In the current cases physical and bacteriological changes in the milk and the udder of the affected animals were showed. Moreover, sign of systemic illness such as reduced feed intake, rises in body temperature, heart rate, and respiration rate were noted, which is similar to the review reported by Mekonnen *et al*. (2005) and Schroeder (2010). It was diagnosed based on the history, observed abnormalities both in the milk and the udder, and laboratory findings. On observation of the milk, changed and looked turbid in colour and contained clots was detected. Similar signs were observed in mastitis and previously reported by Birhanu *et al*. (2017) and Belay *et al*. (2022).

Inflammatory signs were seen in the udder, including ulcerated lesions on the teat and nipple. Similar signs of mastitis were reported by Sharma *et al*. (2007). Similarly, visible change of the udder and the milk in clinical mastitis was previously reported in cow by Kausar *et al.* (2016). The cows with blind quarters, teat damage, and the presence of a rough, irregular, and unclean floor seen in the current examination were strongly associated with higher risk of mastitis as described previously by other authors (Abebe *et al*., 2016; Girma and Tamir, 2022). Furthermore, according to Kitching (2002) description Foot and mouth disease, which was suspected based on its clinical signs in the present instances, may also be linked to the lesions on the udder and teat. This demonstrated the interactions between the host, agent, and environment that were mentioned by other study (Isae and Kurtu, 2018).

The bacterial family that was most frequently isolated from quarters was *Staphylococcus* species (Hogan *et al*., 1989) which also strongly correlated with clinical mastitis (Schabauer *et al*., 2018). In the present report, bacteriological investigation revealed the presence of S. *aureus* as causative agents of the clinical incidents of mastitis in cows. There were other similar findings reported on the isolation of *S. aureus* as a causative agent for clinical mastitis in dairy cattle (Bradley and Green, 2001; Kalmus *et al*., 2006).

A prior investigation by Waage, (2001) reported that 50% of cases of clinical mastitis were brought on by *S. aureus*. Normally, *S. aureus* lives in the udder and mastitis occurs when *S. aureus* enters the teat canal as a result of stress or injury to the udder, improper milking technique, and unsanitary surroundings (Sharma *et al*., 2007). Consequently, maintaining clean floors and good floor condition is essential. In addition, these case studies demonstrate *Streptococcus* species as the causative agent of clinical mastitis in a doe. This is in line with other documented articles that showed *Streptococcus* species have chance to induce clinical mastitis in goats (Pisoni *et al*., 2009; Zamin *et al*., 2010; Mavrogianni *et al*., 2011).

Mastitis caused significant economic losses in Ethiopia, primarily from reduced milk output and culling (Mungube *et al*., 2005). The current case report demonstrates that clinically mastitis-affected cows either entirely cease or appreciably reduce milk production, resulting in milk loss. Even during the drug withdrawal period, the loss was apparent. As a result, these losses could result in considerable economic losses that would severely lower the farmer's net profit for the duration of the lactation.

In the present case studies, animals were treated with systemic injections a combination, , broad spectrum antibiotics with anti-inflammatory drug and Multi-Vitamin. This is in agreement with the description of Sintes *et al*. (2020). On the follow-up periods, in the current study, the cows' general condition improved and discomfort and inflammatory signs reduced that sequentially promote welfare of the animal. The cows were recovering well from the condition. Therefore, the management of mastitis in dairy cows requires early diagnosis, adequate medication, and the implementation of suitable preventative and control measures (Girma and Tamir, 2022). In conclusion, in the current case study clinical mastitis was detected and treated successfully. Therefore, as indicated by the present case study report early treatment using antibiotics together with anti-inflamatory drugs aided in the recovery of a clinical case of mastitis in dairy cattle.

3.1.2. Lumpy skin disease in six calves

Abstract

Lumpy Skin Disease (LSD) is a serious infectious skin disease affecting cattle, characterized by firm skin nodules covering all parts of the body and having a severe economic impact. In the present case study, six Holstein Frisian cross-breed calves were examined on January 18, 2023, at one of the dairy farms in Kombolcha, South Wollo, Ethiopia. The history of the calves revealed inappetance, the presence of skin nodules on different parts of the calves and also swelling of the left hind limb. The lesions were first seen in the two calves before ten days. The ages of the calves ranged from six to eleven months. All other non disease animals aged above six months and two of the diseased calves had vaccination history against LSD virus. On clinical examination, the calves had a temperature of 38.5 to 40.5 ^{O}C, a respiratory rate of 18 to 64 breaths per minute, and a pulse rate of 72 to 120 beats per minute. Variably-sized, firm, painful skin nodules, some with necrotic centres, were seen on different body parts. The stage, site, and number of nodular lesions vary among infected calves. Swelling of the prescapular and prefemoral lymph nodes, conjunctivitis, and corneal cloudiness were also observed. Lameness and oedematous swelling of the left hind limb with pits on palpation and large areas of necrotic lesions over the oedematous limb with skin peeling off were observed from one calf. Based on history, clinical signs, and real time PCR results, the cause was diagnosed and confirmed as Lumpy skin disease. Short-acting oxytetracycline, (10 mg/kg/day, IM,) for 5 days was given to prevent secondary bacterial complications. A Multi-Vitamin (10 ml per calves, IM) was given to boost the calves' appetite. Diclofenac sodium, at 2.5 mg/kg IM, was given once daily for three days. During the follow-up period, only three calves were recovered. The death of the other calves believed to be associated with secondary bacterial complications due to the late report of the case by the owner. Therefore, prevention of LSD by vaccination and promotion of bio-security are more helpful than its treatment, and early reporting is also warranted to avoid losses due to death.

Key words: *Calves, Lumpy Skin Disease, Oxytetracycline, Vaccination*

Introduction

Lumpy skin disease (LSD) is a serious infectious skin disease of cattle characterized by skin nodules that may have inverted conical necrosis, sit-fast (Al-Salihi and Hassan, 2015). It is a viral disease caused by the Lumpy skin disease virus (LSDV), a member of the *Capripoxvirus* genus of the *Poxviridae* family (Gupta *et al*., 2020). "Neethling virus disease", "exanthema nodularis bovis", "Pseudo-urticaria", and "knopvelsiekte" are some of the names given to this disease yet amongst such forenames, "LSD" is the one most commonly employed (Khan *et al.*, 2021).

The virus can cause infection mainly in cattle and buffaloes; there are also reports in other wild ruminant species, such as giraffes, bulls, and springboks (Ratyotha *et al*., 2022). LSD is listed as a notifiable disease by the World Organization for Animal Health (OIE) due to the severe economic impact on the cattle industry due to decreased milk and meat production, abortions, fertility problems, damaged hides and in some cases, death of the animals (Whittle *et al*., 2023). For this reason, the disease is the second significantly important viral disease of cattle in Ethiopia (Tamire, 2022).

Infected animals may present variations in clinical signs ranging from subclinical to high morbidity and mortality (Ratyotha *et al*., 2022). The incubation period of disease in natural conditions is between 2 and 5 weeks, but in experimental conditions, the duration ranges from 7 to 14 days (Gupta *et al*., 2020). LSD takes three forms: acute, subacute, and chronic (Salib and Osman, 2011). It manifests in mild form in cattle as fever, nasal and ocular discharge, and nodular lesions that form on the skin, muscles, and mucosal tissue (Coetzer and Tuppurainen, 2004). Soon after, nodular lesions, which are painful and hyperaemic, may be observed on the animal body, especially in the skin of the muzzle, nares, back, legs, scrotum, perineum, eyelids, lower ear, nasal and oral mucosa, and tail (Salib and Osman, 2011). Moreover, necrotic plaques may appear in the mucous membranes of the oral and nasal cavities, causing purulent or mucopurulent nasal discharge and excessive salivation. Ulcerative lesions may also appear in the cornea of one or both eyes, leading to restricted vision and even blindness (Tuppurainen *et al*., 2021).

The infected animals also typically show poor general body conditions, reduced feed and water uptake, lowered milk production, enlarged lymph nodes, and characteristic skin nodules (Tuppurainen *et al*., 2021). Sometimes found oedema of limbs is caused by lymphangitis and vasculitis (Ratyotha *et al*., 2022). Mucosal lesions in calves develop within 23-48hrs after infection (Al-Salihi, 2014). The resulting wound lesions can develop necrotic tissue and scarring, which may occur with secondary infection with other types of complications such as bacteria, viruses, or myiasis and cause severe clinical symptoms (Ratyotha *et al*., 2022; Whittle *et al*., 2023) like dysentery, lameness, pneumonia, mastitis (Al-Salihi and Hassan, 2015).

All age groups of animals are equally vulnerable to this viral infection but, susceptibility is far higher in calves and immune-compromised animals (Al-Salihi, 2014). LSDV is primarily spread by mechanical transmission of arthropod vectors (Khan *et al.*, 2021) via mosquitoes, ticks and biting flies (Tuppurainen *et al*., 2021). In addition, indirect transmission can also occur when cattle are sharing feed or water troughs contaminated by saliva or nasal discharge from infected animals and with movement of clinically and sub-clinically ill cattle (Sprygin *et al*., 2019). The virus can survive in skin nodules for one month and at least three weeks in air-dried hides (Ratyotha *et al*., 2022). Thus, the main sources of infection are considered to be skin lesions as the virus persists in the lesions or scabs for long periods. The virus is also excreted via the blood, nasal and lachrymal secretions, saliva, semen and milk (Namazi and Khodakaram, 2021).

Morbidity and mortality of LSD varies from 3 to 85% and 1 to 3% (up to 40% in heavy outbreaks), respectively (Ochwo *et al*., 2019). However, according to a fairly recent review document by Dubey *et al*. (2023), the typical death rate was 10% (40% in rare cases), and the morbidity rate ranged from 5% to 45% (sometimes even up to 100%). According to them, these variations in severity were likely to be due to variations in cattle breed, age, immunological condition or health status, viral isolates, insect vectors involved in the transmission, and stage of development.

The diagnosis of LSD can be established based on typical clinical signs or generalized nodular skin lesions and enlarged superficial lymph nodes in affected animals combined with laboratory confirmation of the presence of the virus or antigen (Tamire, 2022).

For laboratory confirmation various diagnostic techniques which require different types of samples need to be performed (Sprygin *et al*., 2019). Molecular diagnoses with conventional and real-time PCR have been developed for the most efficient and rapid diagnosis of the disease (Orlova *et al*., 2006). However, Pseudo-Lumpy skin disease, urticaria, streptotrichosis (*Dermatophilus congolensis* infection), ringworm, *Hypoderma bovis* infection, photosensitization, bovine papular stomatitis, foot and mouth disease, bovine viral diarrhea and malignant catarrhal fever are all considered in the differential diagnosis of LSD (Abutarbush and Bayry, 2017).

Until now no precise and effective antiviral drugs are available for the treatment of LSD. Anti-inflammatory and antibiotics are used for symptomatic treatment (Das *et al*., 2021). To control the disease, effective control and preventive measures need to be implemented, which include: Restrict movement of infected animals, restrict vector movements and vaccination (Gupta *et al*., 2020). Prevention through vaccination is the only effective way of restraining the disease (Das *et al*., 2021). However, the different vaccines used in Ethiopia are not fully effective (Tamire, 2022). Therefore, the present case study reports the occurrence of laboratory confirmed cases of LSD infection in Holstein Friesian cross breed calves in Kombolcha, South Wollo, Ethiopia.

Case description

Six Holstein Friesian cross-breed calves from one of the dairy farms in Kombolcha City Administration were examined on January 18, 2023. The history of the calves revealed inappetance, the presence of skin nodules on different parts, lesion on the hind limb, and eye problems. The lesions were first seen from the two calves (one male and one female). The ages of two calves were eleven months and from six to nine months for other calves. The calves were living with other animals in different age of the same breed in an intensive farming system. Based on the owner's information, one male calf was died before a week. There had been a history of similar cases before two years at the farm and also complaints from another nearby farm before one month. The vaccination history showed that all animals aged above six months and two of the diseased calves had gotten a vaccine against the LSD virus.

In addition, the medical history also shows that the calves were treated with short-acting oxytetracycline, diclofenac sodium, and Multi-Vitamin injection started one day before. All the affected calves were taken from the isolated pen of the farm and examined clinically there. The performed physical examinations including the specific identification and clinical sign from each calf were recorded (Table 1).

On clinical examination the calves were having temperature of 38.7 to 40.5 ^{O}C; respiratory rate from 18 to 64 breaths/min and pulse rate were form 72 to 120 beats/min. Varies sized skin nodules were seen from the neck, ear, teat, perineum, face, back, muzzles and scrotum. The nodules were firm, painful and raised above the surrounding skin and in some cases separated by narrow ring of haemorrhage with characteristic intact central area.

The stage, site and number of nodular lesions vary among infected calves. A typical ring-like ulcerative lesions from the muzzle and external nose (only two calves), and ocular-nasal discharge which stain the face, swelling of prescapular and prefemoral lymph nodes, conjunctivitis and corneal cloudiness (both eyes of one calf) were also observed. Severe depression and oedematous swelling of left hind limb with pits on palpation, large areas of necrotic lesions over oedematous limb with skin peeling off and lameness were observed from one calf. The skin lesions and clinical features of LSD in the affected calves are indicated in Figure 4.

Therefore, based on history, observed clinical findings and endemic nature of the disease in Ethiopia the case was tentatively diagnosis as LSD and appropriate nasal swab and nodular skin biopsy samples were collected for further laboratory confirmation.

Table 1: Identification, clinical signs, and treatment outcome of calves affected by LSD.

No	Sex	Age (month)	Observed clinical signs	Body temperature (oC)	Respiratory rate (breath/min)	Pulse rate (beat/min)	Vaccination history	Outcome
1	F	11	Skin nodules from the neck, face, ear, muzzle, back, perineum, and teat, ulcerative nodular lesions from the muzzle and external nose, ocular and nasal discharge, swollen lymph node and necrotic lesions over oedematous limb with skin peel off and lameness.	39.9	64	120	Yes	Died
2	M	9	Skin nodule from the neck, rectum, and scrotum, ocular discharge, swollen lymph node.	40	36	98	No	Recovered
3	F	6	Skin nodules on the neck, face, and ear.	38.9	28	104	No	Died
4	F	11	Skin nodules on the neck, face, ear, perineum, and teat, ocular discharge, conjunctivitis and corneal cloudiness, and salivation.	40.5	48	92	Yes	Killed by the owner
5	F	8	Skin nodules on the neck and face.	39.3	18	84	No	Recovered
6	F	6	Skin nodules on the neck, swollen lymph node	38.7	22	72	No	Recovered

Figure 4: Characteristic skin lesions and clinical features of LSD in HF cross breed calves. Typical ring-like ulcerative lesions from the muzzle and external nose (A), raised nodules separated by narrow ring of haemorrhage after the hair over the nodule clipped off (B), different sized and stage skin nodules on the neck and face (C), necrotic lesions over oedematous limb with skin peel off (D), nodules on the testicle (E), conjunctivitis and corneal opacity (F), and the affected calves at day one (G).

Sample collection and laboratory findings

The calves were restrained properly with care using appropriate techniques to avoid stress or injury. Nasal swab and cutaneous nodule were collected. The nasal swab samples were collected by vigorously rubbing the swab on the lining inside the nose. The selected nodule was prepared aseptically and the hair over the nodule was clipped off, anaesthetized locally using 2% lidocaine and nodular biopsy was surgically removed and taken aseptically using scalped blade No. 24 and thumb forceps and the area was cleaned with 1% iodine. After having collected the samples, it was properly labelled with a history, including the provisional diagnosis, in sterile universal bottle that contain viral transport media (VTM) and then sent with cold chain to Veterinary Institute of Ethiopia (NVI). Finally, the real time PCR amplification result and melting curve analysis showed the presence of the LSD virus in both nasal swab and tissue samples (Fig. 5).

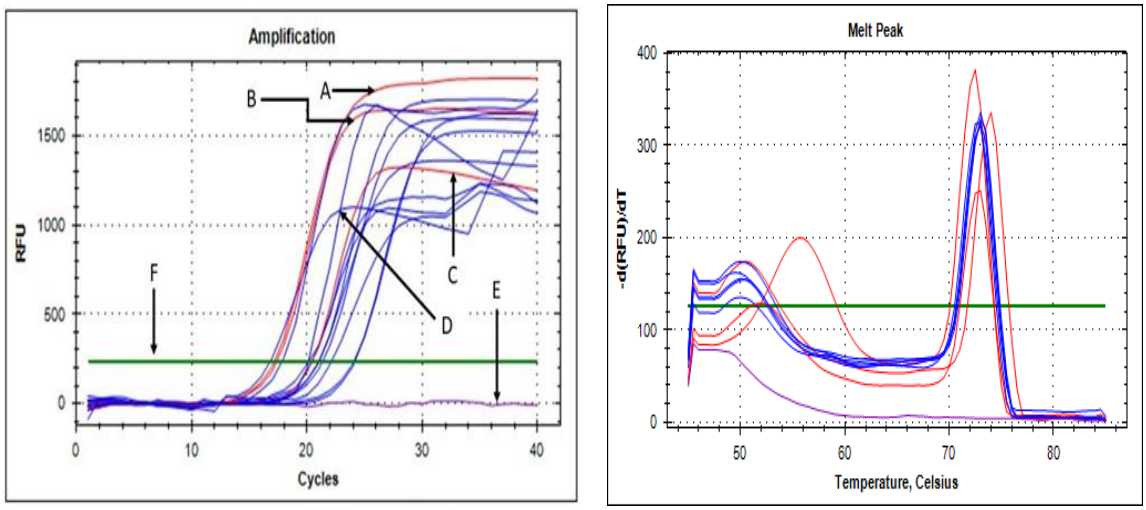

Figure 5: Detection of LSDV from nasal swab and skin nodule samples. Real time polymerase chain reaction amplification result (left) and melting curve analysis (right). A=Known lumpy skin disease virus, B=Known goat pox virus, C=Known sheep pox virus, D=field samples (blue colours), E=negative control and F= Threshold value.

Further, the samples were then inoculated on ESH-L cell and the cytopathic effect was observed on the cell line (Fig. 6).

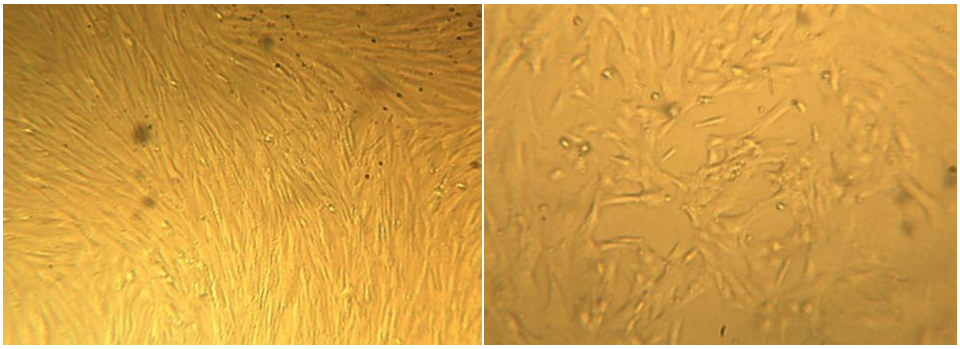

Figure 6: Isolation of LSDV on ESH-L cell line. Non-infected ESH-L cells and cytopathic effect provoked by LSDV at day 6 (left to right).

Therefore, based on history, clinical indications, cytopathic effect and real time PCR results, the cause was diagnosed and confirmed as Lumpy skin disease.

Case management and treatment outcome

As LSD is a viral disease, the treatment of the calves was aimed to avoid secondary bacterial infection and reducing pain to the animal and losses due to the disease and for welfare reasons. Thus, the previously arranged medications were continued. Oxytetracycline (Herbei Hobe Harmony Pharmaceutical, Co. Ltd., China) at 10mg/kg/ day, IM, for 3-5 days (depending on the severity) was given to prevent secondary bacterial complications. Multi-Vitamin, 10 ml per calves, IM, was given to boost the appetite of the calves. Diclofenac sodium (Reyong pharmaceutical Co. Ltd., China), at 2.5 mg/kg was given once daily for three days. The skin wound was cleaned and disinfected using iodine solution. Topical eye ointment was applied for the management of ocular lesions in the affected calf. The owner was advised to provide soft palatable food. During the follow-up period, only three calves were recovered. At two month visit, the recovered calves were in healthy condition (Fig. 7).

Figure 7: Calves recovered from LSDV infection at two months of the follow-up period.

Discussion

Lumpy skin disease is a serious infectious viral disease of cattle. It occurs in an acute or chronic form and causes serious economic losses (Al-Salihi and Hassan, 2015). In this case study clinical infection of LSD was examined from Holstein Frisian cross breed calves under one year old in one dairy farm in Kombolcha, South Wollo, Ethiopia. Likewise, LSD was found from four months old calves with nodular growth on different part of the body, reduced appetite, emaciation, nasal discharge and lameness in India (Halder and Seikh, 2022). Previously, clinical case report of LSD was reported in Ethiopia, in bull with fever and presence of large sized circumscribed nodules on different body parts and particularly in the neck area by Feyisa (2018). In this case study, varies sized skin nodules, typical ring-like ulcerative lesions from the external nose, salivation and occulo-nasal discharge, swelling of prescapular and prefemoral lymph nodes were observed up on clinical examinations of the affected calves.

Besides, conjunctivitis and corneal cloudiness, oedematous swelling of limb, large areas of necrotic lesions over oedematous limb with skin peel off and lameness were revealed. Fever, depression and reduced feed intake were also distinguished. As a result, the clinical findings in this case study were in agreement with LSD signs reported and described by other authors (Salib and Osman, 2011; Tageldin, 2014; Feyisa, 2018; Mulatu and Feyisa, 2018; Tuppurainen *et al*., 2021).

The skin lesions and nodules were observed on different body areas mainly on the neck and faces. After the hair covering the nodule was trimmed off, raised nodules with a

distinctive intact centre area and a small ring of bleeding were visible. This is in consistence with the review by Mulatu and Feyisa (2018).

In the present case, typical ring-like ulcerative lesions were showed from the muzzle and external nose. This is due to sloughing of the necrotic lesions from the surrounding healthy epithelium (Al-Salihi, 2014). In this case report conjunctivitis and corneal opacity were investigated in nine months old calf. Similar sign was reported by Sudhakar *et al*. (2020) from outbreaks of LSD in cattle in India. The observed clinical signs such as ulcerative lesions, conjunctivitis, corneal opacity and lameness might occurred as severe clinical symptoms with complications of secondary bacterial infections (Al-Salihi and Hassan, 2015; Ratyotha *et al*., 2022; Whittle *et al*., 2023). The oedematous swelling of limb in this case study was observed from one calf which might be due to lymphangitis and vasculitis (Ratyotha *et al*., 2022). According to Tageldin *et al*. (2014), these clinical signs were much more severe and highly prominent in Holstein–Friesian cattle, particularly in young calves. They claimed that any stress factor like high ambient temperatures or malnutrition, coupled with farming practices to produce high milk yields in young calves, contributed to the severity of the disease.

The presence of LSD-like nodules after vaccination ranges from 0.38% to 12% (Bamouh *et al*., 2021). In the present case study, two of the affected calves had a five month vaccination history against LSDV. This is probably due to the incomplete effectiveness of the vaccine, incorrect dosage of the vaccine at the time of vaccination, the low response level of the calves to vaccine (Namazi and Khodakaram, 2021), or the calves might be missed during vaccination.

In the current case study, the calves were treated using short-acting oxytetracycline, Multi-Vitamins, and diclofenac sodium with the aim of avoiding secondary bacterial infection with antibiotics and reducing losses due to the disease and pain to the animal for welfare reasons. Similarly, the treatment protocol was in agreement with the management of the LSD case by Salib and Osman (2011). The most recent assessment by Dubey *et al*. (2023) revealed that while the fatality rate is typically 10%, it can occasionally rise to 40%. During the follow-up period three of calves were recovered and the others died. The case of death in the present instance might be due to lesions in the ocular and respiratory

tract that probably prolong the period of anorexia and develop secondary pneumonia, which is a common sequel to LSD (Al-Salihi, 2014) that arise from the late detection and report of the cases by the owner. In conclusion, LSD is a debilitating disease that causes significant economic loss due to the deaths of the affected animals and has great implications for animal health and welfare. Therefore, prevention of LSD by vaccination and promotion of bio-security are more helpful than its treatment, and early case reporting is also warranted to avoid losses due to death.

3.1.3. Foot and mouth disease in cattle

Abstract

Foot and mouth disease (FMD) is one of the most widespread diseases of cloven hoofed animals in the world caused by the foot and mouth virus. This case study report describes the occurrence of FMD in cattle and its management. Salivation, lameness, inappetance, drooling of saliva, lesions on the gums and tongue, and lameness were the primary complaints by the owners. During physical examinations, the animals were febrile, with rectal body temperatures ranging from 40.0 to 41.6 ^{O}C. Respiratory and heart rates were increased. Ruptured vesicles, erosions and ulcers in the mouth, on the tongue, gums, and interdigital spaces, and excessive drooling of saliva were noted. Dorsal displacement of epithelium of the tongue and congested mucous membrane was also observed. The cause was diagnosed based on history, clinical signs, disease epidemiology, and the cell culture virus isolation test result. Animals were managed by applying broad-spectrum antibiotics, supportive therapies and dressing lesions with disinfectants. The animals were fully recovered with varying revival periods. In conclusion, the present case report indicates the occurrence and management of FMD lesions in cattle. Therefore, as there is no particular treatment of the disease, identification of the specific serotype of the virus and vaccination of cattle with that serotype is recommended in the area. In addition, provisions of soft feedings are warranted in FMD cases with presence of ulcer on the mouth and tongue.

Key words: *Cattle, Foot and Mouth Disease, Treatment, Vaccination*

Introduction

Foot and mouth disease (FMD) is a picornaviral infection that affects both domestic and wild animals with cloven hooves (Pacheco *et al*., 2010). The disease is one of the most economically significant trans-boundary diseases of livestock (Sarker *et al*., 2011). It is the primary disease limiting international trade in animals and animal products due to the extremely infectious nature of the virus and the severity of the economic effects associated with the disease (Arzt *et al*., 2011). Thus, this disease prevents the nation from earning money from livestock and restricts ability to engage in international trade (Jibat *et al*., 2013).

The disease is marked by vesicular lesions on the feet, mouth, snout, and teats, fever, lameness, (Arzt *et al*., 2011), loss of appetite and salivation (Gelaye *et al*., 2009). In addition, localized vesicles (blisters) on the tongue, dental pad, or another place of the skin that burst in three days to leave shallow erosions (Tolawak and Pal, 2022). Despite not having a high mortality rate in adult animals, FMD has serious consequences such as weight loss, a reduction in milk supply, reproductive problems, and a loss of draught power, which leads to decreased production. The virus induces cardiac degeneration in young animals, which can lead to a high mortality rate (Sarker *et al*., 2011).

The clinical disease varies depending on the species, breed, and FMD viral strain and serotype of the infected animal (Kitching, 2002). The animals continue to stay in poor physical condition after being retrieved, which causes financial losses for the cattle industry (Gelaye *et al*., 2009). The cluster of clinical symptoms known as "heat-intolerance syndrome" (HIS) is a common FMD complication that affects cattle in Africa.

It is characterized by intolerance to heat, and affected animals exhibit considerable panting, an increase in body temperature and heart rate in hot conditions, as well as abnormal hair growth (Jibat *et al*., 2013).

The FMDV belongs to the family Picornaviridae and is from the genus Aphthovirus. There are seven immunologically distinct serotypes of the virus that causes Foot-and-mouth disease, namely O, A, C, South African Territories (SAT)-1, SAT-2, SAT3, and Asia-1 (Sarker *et al*., 2011).

The most widely distributed serotypes are A and O, which are found in South America, Asia, and Africa. Asia1 is currently limited to Asia, whereas SAT1, 2 and 3 are exclusively available in Africa (Mekonen *et al*., 2011). Moreover, recovery from serotype-specific infection with one serotype does not confer protection against the other six serotypes (Kitching, 2002). In Ethiopia, serotypes of A, C, O SAT-1, and SAT-2 have been identified (Seyoum and Tora, 2023).

The virus is primarily spread through direct or indirect contact with infected animals, their secretions, or contaminated food products (Arzt *et al*., 2011). In addition to transmissions between animals, FMDV can also spread mechanically through objects like clothing, footwear, and veterinary equipment (Awel *et al*., 2021). The introduction of the virus types or subtypes to locations where they were previously absent leads to epidemics of various extent because the disease is extremely contagious and can travel as much as 50 miles downwind from one outbreak area to another (Mekonen *et al*., 2011). Furthermore, the virus spreads rapidly to fully susceptible populations as a result of its high level of infectiousness, high respiratory secretion titters, prolonged survival in secretions, quick replication cycle, and short incubation period (Awel *et al*., 2021). Therefore, because the respiratory tract is the principal site of virus replication, respiratory aerosols are the primary mechanism of virus transmission (Tolawak and Pal, 2022).

The diagnosis of FMD infection depends mainly on the combination of clinical indicators with laboratory testing to determine the serotypes of the causal virus (Admassu *et al*., 2015a). However, lesions caused by bovine popular stomatitis, bovine herpes mammillitis, bovine rhinotracheitis, bovine mucosal disease, malignant catarrhal fever, rinderpest in cattle, bluetongue, peste des petits ruminants, and foot root in sheep can all be mistaken for FMD, and all of these diseases should be considered during the diagnosis (Balemual, 2018). Therefore, the detection and isolation of live FMD virus is required for definitive FMD diagnosis, which is required at the commencement of an outbreak (Kitching *et al*., 2005).

There is no cure for foot and mouth disease (Admassu *et al*., 2015a). However, treatment of subsequent bacterial infections and treatment of lesions with good animal husbandry procedures is advised (Radostits *et al*., 2006). In addition, quarantine, a restriction of animal movement, isolation of infected animals, proper disposal of infected carcass and vaccination programs are also important (Admassu *et al*., 2015a). Therefore, this case study report describes the occurrence of FMD in cattle in Kombolcha and Dessie city administrations, South Wollo, Ethiopia.

Case description

There was received information about an outbreak of FMD from Kombolcha and Dessie City Administrations, South Wollo, Ethiopia on December 16, 2022. Inappetance, drooling of saliva, lesions on the gums and tongue, and lameness were the primary complaints. Two deaths of male calves were notified by two different dairy farm owners in Kombolcha city administration. Cattle from different breeds, ages, production systems, and both sexes were affected. Animals were clinically examined with evidence of suggestive FMD clinical signs. For this case report purpose three animals (two from Dessie and other one Kombolcha city administration) were followed for their recovery status. The history of each animals was collected from the owners.

During physical examinations, the animals were febrile, with rectal body temperatures ranging from 40.0 to 41.6 ^{O}C. Increased respiratory and heart rates were noted. Ruptured vesicles, erosions and ulcers in the mouth, on the tongue, gums, and interdigital spaces, and excessive drooling of saliva were observed. Dorsal displacement of epithelium of the tongue, panting, and congested mucous membrane was also noted. Severe weight loss and emaciation were markedly observed in a seven year cross breed cow. The observed clinical indicators of FMD are presented in Figure 8.

Figure 8: Indicating the typical clinical signs of FMD in cattle. Erosion on the tongue (A) and muzzle (B) with excessive drooling of saliva (A and B), erosion in the interdigital space (C) and upper gum (D and F), oral cavity (E). Sever weight loss and emaciation due to complete inappetance (G), panting, salivation and lesions on tongue (H) in seven years old cow.

Based on the history and typical clinical signs, the case of the outbreak was tentatively diagnosed as Foot and mouth disease.

Sample collection and laboratory finding

The animals were restrained properly and appropriate nasal swab and epithelial tissue samples were collected aseptically. Samples were taken with care, to avoid stress or injury to animals, and submitted to the laboratory clearly. The nasal swab samples were collected by vigorously rubbing the swab on the lining inside the nose. About 1 g of epithelial tissue was collected aseptically with the help of tissue forceps. The sample was immersed in 2 ml of viral transport media (VTM) in sterile plastic screw-cap tubes and permanently labelled with the required information. Then it was sent with a cold chain to the National Veterinary Institute (NVI) for further laboratory confirmation by molecular identification of the antigen. Unfortunately, the molecular test result was not ready during compiling the case, and as a result, the presence of FMD virus in the tissue sample was recognized only based on virus isolation in cell culture. The test result showed the detection of characteristic cytopathic effect on Baby Hamster Kidney (BHK-21) cell line due to the presence of FMD virus that causes FMD (Fig. 9).

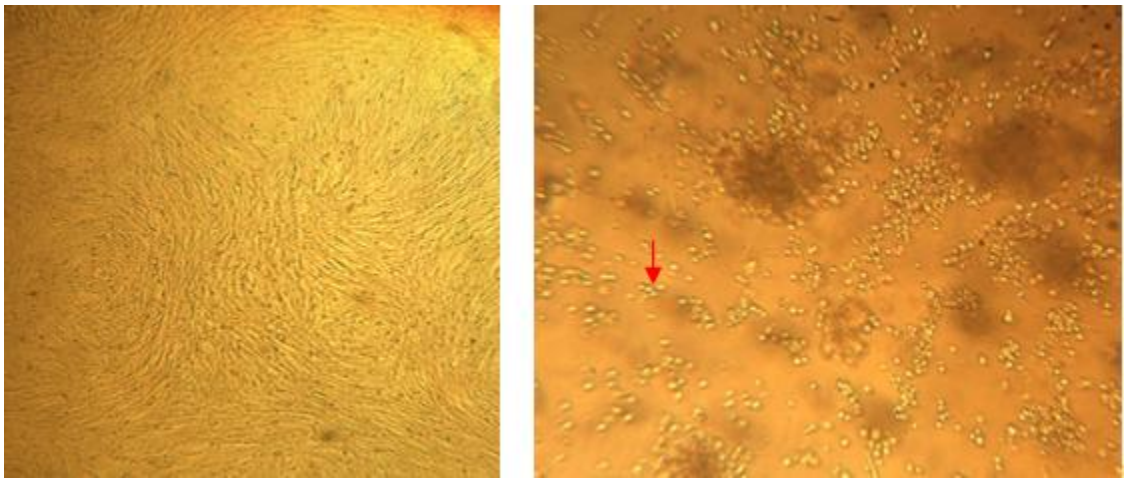

Figure 9: The characteristic cytopathic effect of FMDV on BHK-21 cell line. Noninfected (healthy) BHK-21 cell line (left) and FMD virus infected round cell (red arrow) showing the cytopathic effect (right).

Therefore, based on history, clinical signs observed, disease epidemiology, and virus isolation test results the cause of the outbreak was diagnosed as Foot and mouth disease.

Case management and treatment outcome

As FMD is a viral disease and treatment is to control secondary bacterial infection by applying broad-spectrum antibiotics and dressing lesions with disinfectants with proper animal husbandry practices. Thus, the cases were managed by 10% oxytetracycline (Shenyang Sunvictor Pharmaceutical Co., Ltd., China) at 0.1ml per kg body weight IM, daily for three days. Dexamethasone sodium phosphate at 0.2 mg/kg daily for three successive days was given. Additionally, Multi-Vitamin injections until the normal appetite resumed were also given. Lesions were cleaned and disinfected using iodine solution for 3-5 days. Owners were advised to nourish their animals with soft, palatable feed and isolate affected animals from healthy animals. The animals were followed actively and by phone call, and were fully recovered with varying recovery periods. During the follow-up periods, a resumption of body temperature to its normal value was observed after start of treatment. Clinical lesions healed, and animals were able to eat on subsequent days of the post-treatment period. However poor physical condition after being retrieval was observed from the two followed animlas (Fig. 10A and B).

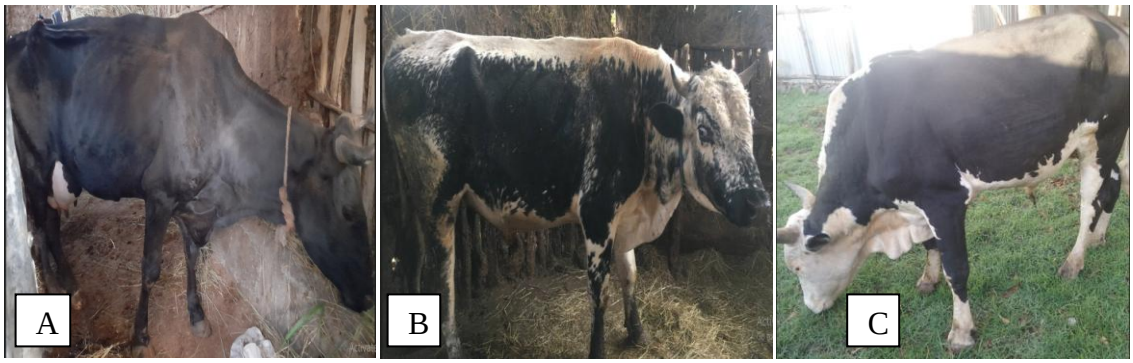

Figure 10: The condition of animals recovered from FMDV infection. A cow in Figure 8G and H stay in poor physical condition after retrieved (A), a bull after lesions healed (B), and a bull during grazing (C).

Discussion

Foot and mouth disease (FMD) is one of the most widespread diseases of many species of animals in the world caused by FMD virus (Tolawak and Pal, 2022).

In the present instance, FMD was examined and diagnosed in cattle based on the history, clinical signs, and disease epidemiology and virus isolation in cell culture. The observed FMD signs and lesions were in close agreement with the report of Grubman and Baxt (2004) and Jibat *et al*., 2013). However, the characteristic lesions were varying in severity and manifestations in each animal. This could be related to virus strains, viral infection dose, breed susceptibility, management strategy, and exposure to prior infection (McLaws *et al*., 2009). In the present case the characteristic cytopathic effect of FMDV on BHK-21cell line were noticed. FMDV infected cell were showed rounding, flattening, and aggregate formation. Similar, features of FMD virus on BHK-21 cell line were reported by Tesfaye *et al*. (2020) and (Mahmud *et al.*, 2017).

FMD does have debilitating symptoms such as weight loss, decreased milk output, and loss of draught power in adult animals. However, young animals are more likely to experience death, (Grubman and Baxt, 2004). Similarly, two deaths of male calves were noted from the history and a cow with loose condition was observed in the current instances.

In the present case study, the affected animals were managed by using administration of antibiotics for secondary bacterial complication along with supportive therapy including provision of soft palatable feed. Such a management approach has previously been suggested by (Radostits *et al*., 2006; Admassu *et al*., 2015a). Moreover, the application of traditional treatment methods used in the management of FMD lesion with araki, honey, boiled cabbage, fumigation with herb smoke, salt and hot chilies was previously reported by Mesfine *et al.* (2019). The management of FMD lesions using honey and finger millet flour in dairy herd was also reported by Gakuya *et al*. (2011). In conclusion, the present case report indicates the occurrence and management of FMD lesions in cattle. Therefore, as there is no particular treatment of the disease, identification of the specific serotype of the virus and vaccination of cattle with that serotype is recommended in the area. In addition, maintaining nursing care like provisions of soft feedings are warranted in FMD cases with ulcer on the mouth and tongue.

3.1.4. Lumpy skin disease and Foot and mouth disease co-occurrence in a heifer

Abstract

LSD and FMD are common viral diseases of cattle which have a negatively affect the health and reproductive performance of the animals. This case report describes the concurrent LSD and FMD infections in a cross-breed heifer in Kombolcha, South Wollo, Ethiopia. The main complaints were reduced feed intake, oral lesions, lameness, skin nodules, and salivation. The clinical manifestation indicating both FMD and LSD were observed during physical examination. Appropriate samples were taken for laboratory examinations of both diseases. The presence of cytopathic effect on BHK-21 and identification of antigen using polymerase chain reaction (PCR) of tissue sample from infected heifer revealed both FMD and LSD virus, respectively. Therefore, based on history, clinical signs observed, and laboratory result, the cause was diagnosed and confirmed as co-infections of the heifer with FMD and LSD. Treatment with intramuscular injections of oxytetracycline once a day for five days, anti-inflammatory drug dexamethasone daily for three days and a Multi-Vitamin until the heifer resumed a normal appetite was arranged and started. Lesions were cleaned and disinfected using iodine solution. Owners were advised to nourish the heifer with soft, palatable feed and isolate her from the healthy animals. Unfortunately, the heifer died while under treatment on the third day of handling. In conclusion, this case report indicates the possibility of the uncommon co-occurrence of the two major contagious viral diseases of cattle and thus, vaccinating animals against LSDV and FMDV is recommended.

Key words: *Co-occurrence, Foot and Mouth Disease, Heifer, Lumpy Skin Disease,*

Introduction

Lumpy skin disease (LSD) and Foot and mouth disease (FMD) are common viral diseases of cattle which have a negative impact on the animal's immunity, health, and reproductive status (Abas *et al*., 2021). LSD is an economically important viral disease in cattle caused by the LSD virus of the genus *Capripoxvirus* (Omoniwa *et al*., 2023). The disease causes fever, swollen lymph nodes, and nodules on the skin, mucosal membranes, and internal organs (Sevik, 2017).

On the other hand, FMD is characterized by vesicular lesions on the feet, mouth, snout, and teats, the illness is marked by fever, lameness, (Arzt *et al*., 2011), loss of appetite, salivation (Gelaye *et al*., 2009). In addition, localized vesicles (blisters) on the tongue, dental pad, or another place of the skin that burst in three days to leave shallow erosions (Tolawak and Pal, 2022).

Co-infections in viral diseases of cattle were uncommon and/or less reported. A mixed infection of LSD with pseudocowpox was reported by Omoniwa *et al*. (2023). Based on common clinical symptoms and in accordance with the clinical hallmarks of both disorders, FMD and LSD were clinically diagnosed (Abas *et al*., 2021). However, laboratory examination is confirmatory, as described in the literature (Admassu *et al*., 2015a; Tamire, 2022). Both FMD and LSD are important diseases in Ethiopia. Therefore, this case report describes the co-occurrence of LSD and FMD in HF cross-breed heifer in Kombolcha, South Wollo, Ethiopia.

Case description

Mr. Kedir Mohamed presented the case of his Holstein Frisian (HF) cross-breed heifer to the Kombolcha City Veterinary Clinic on December 09, 2022 with complaints of reduced feed intake, oral lesions, lameness, skin nodules, and salivation. The heifer was kept intensively with three other cows and an ox in the same shade. He mentioned that the animals were purchased from South Gondar Zone before one month with unknown vaccination histories, and the rest of the animals were treated with ivermectin and long-acting oxytetracycline upon arrival on the farm. Based on his complaint, a farm visit was made, and physical examinations were conducted at the heifer's barn.

Upon physical examination, the heifer was depressed and febrile, with a rectal body temperature of 40.5 ^{O}C. Respiratory and heart rates were 56 breaths per minute and 120 rates per minute, respectively. The prefemoral and prescapular lymph nodes were swollen. There were typical, variable-sized nodular lesions seen, particularly on the skin of the neck, shoulder, teat, around the vulva, and on the face including the ear and mouth. The heifer was depressed, and the left hand limb was swollen and pitted on palpation.

There were extensively necrotized lesions on the exterior of the nose, ruptured tissue on the gum, partially displeased dorsal epithelium of tongue, drooling of saliva, ruptured vesicles on the digits, swelling on the lower jaw. Ocular and nasal discharge, reddened ocular mucous membranes and lameness were also observed. The clinical hallmarks are presented in Figure 11. Based on the history and typical clinical findings, the case was tentatively diagnosed as a mixed infection of Foot and mouth disease and Lumpy skin disease.

Sample collection and laboratory findings

Samples were taken for both FMD and LSD with care, using appropriate techniques to avoid stress or injury to animals, and submitted to the laboratory for PCR. The heifer was restrained properly before collecting the sample. Accordingly, for laboratory diagnosis of LSD, an excisional biopsy of a cutaneous nodule was collected. The selected nodule was prepared aseptically, and the hair over the nodule was clipped off. The area was anesthetized locally using 2% lidocaine, and the entire nodular biopsy was surgically removed and taken aseptically using scalped blade No. 24 and thumb forceps. The area was sutured and cleaned with 1% iodine as an antiseptic. Similarly, for the laboratory diagnosis of FMD, about 1 g of epithelial tissue sample from the tongue was collected aseptically with the help of tissue forceps. After having collected the tissue samples, they were properly labelled with a history, including the provisional diagnosis, kept in sterile universal bottles that contain viral transport media, and then sent with cold chain to the National Veterinary Institute (NVI), Ethiopia, for laboratory examination. The presence of cytopathic effect on BHK-21 and identification of antigen using polymerase chain reaction (PCR) of tissue samples from infected heifer revealed both FMD and LSD virus, respectively. Therefore, based on history, clinical signs observed, and laboratory result, the cause was diagnosed and confirmed as co-infections of the heifer with FMD and LSD.

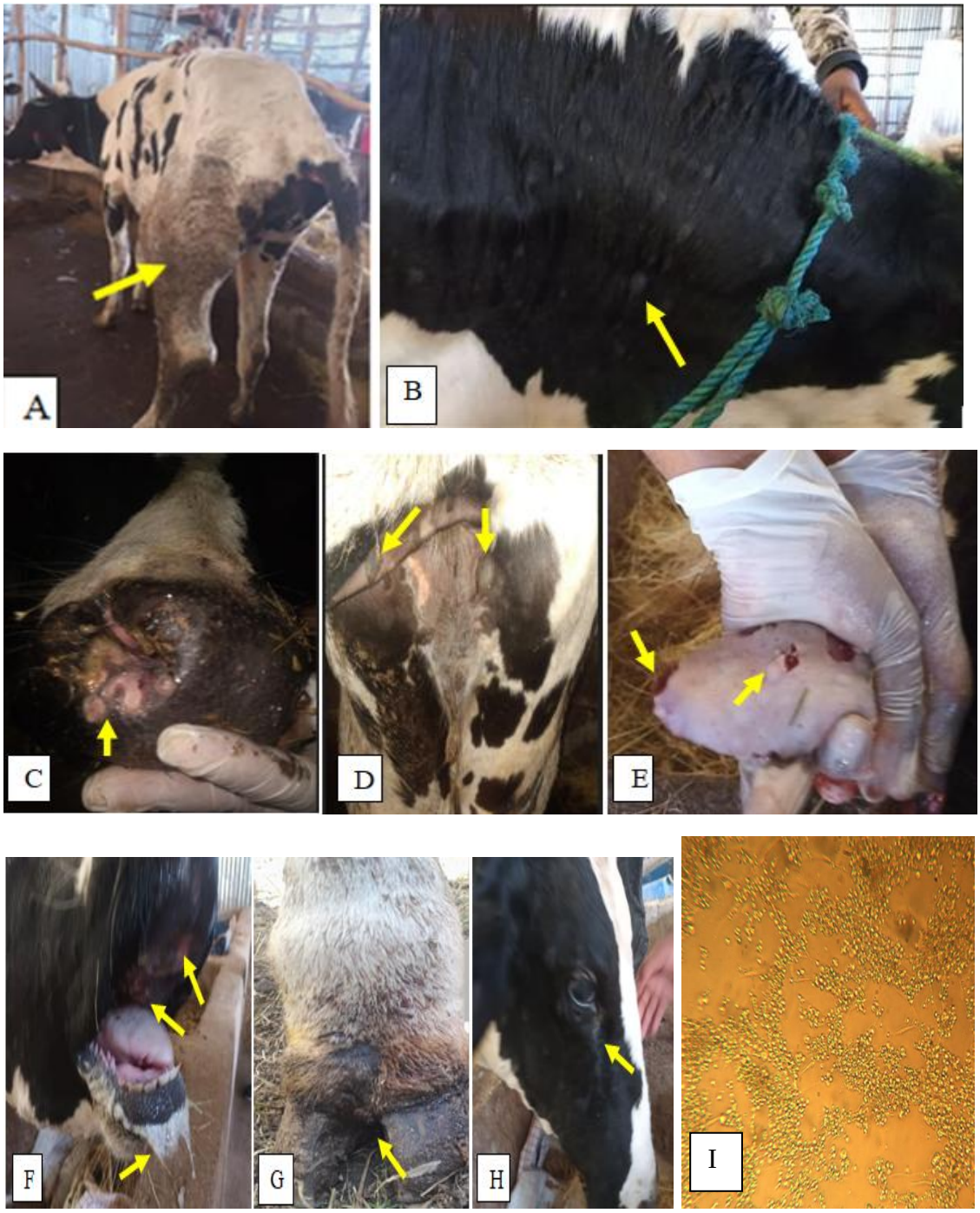

Figure 11: The different clinical indications of both FMD and LSD in HF cross breed heifer. A heifer with swollen left hind limb (A), skin nodules around the neck (B), nasal discharge and necrotized lesions on the exterior of the nose (C), nodules around the perineum (D), a tongue with partially displeased dorsal epithelium (E), lesions on the oral cavity with salivation (F), lesion in the digit (G) and lacrimation (H). The cytopathic effect of FMDV on BHK-21 cell line (I).

Case management and treatment outcome

Since both FMD and LSD are viral diseases, treatment is to control secondary bacterial infection by applying broad-spectrum antibiotics and dressing of lesions with disinfectants with proper animal husbandry practices. Management of the case with short-acting oxytetracycline (Herbei Hobe Harmony Pharmaceutical Co. Ltd., China) IM, at 1ml per 10kg body weight once a day for five days, anti-inflammatory drug dexamethasone daily at 0.2 mg per kg body weight for three days and a Multi-Vitamin (20 ml) IM injection until the heifer resumed a normal appetite was arranged and started. Lesions were cleaned and disinfected using iodine solution daily. Owners were advised to nourish the heifer with soft, palatable feed and isolate her from the healthy animals. Unfortunately, the heifer died while under treatment on the third day of handling.

Discussion

In the present report a heifer was examined with clinical manifestation indicating both FMD and LSD in Kombolcha, South Wollo, Ethiopia. The presence of cytopathic effect on BHK-21 and molecular examination of tissue sample from infected heifer revealed both FMD and LSD virus, respectively. Thus, the results suggest that the clinical symptoms were as co-infections provoked by the two diseases. The diagnosis of the case is also supported by the fact that FMD was present in the area at the time the current case occurred. Mixed infection of these two diseases was previously reported by Sevik (2017) in calf with clinical signs of fever (40 ^{O}C), limping, nasal secretions, and lesions on the skin and vesicles on mucous membranes of the mouth. These clinical manifestations were comparable to those seen in the present report.

In conclusion, this case report indicates the possibility of the uncommon co-occurrence of the two major contagious viral diseases of cattle. Thus, vaccinating animals against LSDV and FMDV is recommended.

3.2. Compiled Clinical Case Reports on Sheep and Goats

3.2.1. Infectious keratoconjunctivitis in goats and ram

Abstract

Infectious keratoconjunctivitis (IKC) is common diseases affecting small ruminants. The present case report describes the detection and successful clinical management of two separate cases of IKC in goats and a ram, with primary complaint of eye problem. All the animals in both cases had history of transportation, and were managed extensively. The rectal body temperature of the ram was 39.9 ^{O}C and from 40 to 40.5 ^{O}C for goats. The respiratory and pulse rate were in the normal range. Varying degree of corneal cloudiness, hyperaemia of conjunctival tissues, and serious to mucoid ocular discharge which is matted around the eye was observed from the affected animals. In addition, the entire corneal was opaque with ulceration of the right eye of the ram. Ocular swab sample from the ram was taken and gram staining techniques was performed and then *Staphylococcus* organism was ruled out as causative agent. The cases were diagnosed as stage II and III IKC in the goats and ram, respectively. Clinical management of the cases using oxytetracycline (20%) at 20 mg/kg body weight/day, IM, for two and three days in goats and ram, respectively, 48 hrs apart along with daily topical eye ointment for seven days was used. Furthermore 1% ivermectine 1ml/50kg/day, SC, stat was given for goats. The owners were advised to separate affected animals from the other herd until complete recovery observed. Significant improvements in eye condition in both cases and complete recovery of the affected goats were observed during follow-up period. No recurrence was occurred during one month follow-up by phone call. In conclusion, IKC was detected in goats and ram at different stages of the disease and the treatment arrangement and prognosis were excellent as the affected animals were recovered successfully with varies complete recovery period that might be due to different in immune status of the affected animals. Therefore, early report and management of the disease is essential by reducing animal distress and to minimize spread within the group.

Key words: *Goat, Infectious Keratoconjunctivitis, Oxytetracycli*ne, *Ram*

Introduction

Infectious keratoconjunctivitis (IKC) is a highly contagious disease in small ruminants which is caused by the bacterium *Mycoplasma conjunctivae and* may also be brought on by *Chlamydophila pecorum, Pseudomonas species,* and *Staphylococcus aureus* in sheep and goats (Rahaman *et al*., 2018). Infections with *Mycoplasma* mainly *Mycoplasma conjunctivae* is the primary etiological factor in goats (Cabras *et al*., 2008). The condition, which is sometimes referred to as Pink-eye in sheep and goats, is characterized by inflammation of the cornea and conjunctiva (Jesse *et al*., 2017). As a result, this infection will lead to inflammation of the conjunctiva, cornea, and tissue lining the eyelids, which may develop to ulceration, induce pain, and worsen, which may result in temporary or permanent blindness (Abdullah *et al*., 2013). Several factors, including as the immunological status of the susceptible animal, the severity of the pathogenic strain involved, environmental factors, and secondary infections, all affect the disease. Stresses factors that predispose to the disease include irritants, transportation stress, bright sunlight, and dusty environments (Abdullah *et al*., 2015a).

Transportation stress might have precipitated the disease (Abdullah *et al*., 2014) and causes immunosuppression which allows for multiplication and colonization of invading bacteria (Zamri-Saad *et al*., 1994). On the other hand, IKC is a secondary infection due to stress facilitated by some concurrent diseases like pest petites ruminitis and myiasis (Rahaman *et al*., 2018).

In ruminants, the disease has four stages (Whittier *et al*., 2009). Thus, Conjunctivitis, lacrimation, blepharospasm, and different stages of corneal opacity and ulceration are typical signs of infection in animals (Abdullah *et al*., 2014). The earliest signs include blepharospasm, hyperaemia, serous lacrimation, increased blinking, and hyperaemia (Athira *et al*., 2018). Later on, the conjunctival blood vessels enlarge and move over the cornea. Particularly in the periphery, the cornea may turn black or gray and 2 to 5 days later, the exudates turn purulent (Akerstedt and Hofshagen, 2004). As the ulcer nearly completely covers the cornea and the inflammation spreads into the inner components of the eye, the disease will move to the next stage.

If the disease is not addressed, stage IV will appear as the ulcer expand all the way through the cornea and possibly even have the iris protruding through it (Jesse *et al*., 2017). The disease will be healed if it is started at its earliest stage by preventing the progression of either temporary or permanent blindness (Abdullah *et al*., 2014).

The diagnosis of the infection is made based on the clinical indications, isolation and identification of organism from the eyes of the affected animals (Athira *et al*., 2018). However, provisional diagnosis of the disease is typically adequate based on ocular sign and systemic infection. Oxytetracycline is commonly considered the drug of choice for systemic therapy due to its concentration in the cornea (Jesse *et al*., 2017). The disease is frequently self limiting but early treatment will avoid scarring of eyes (Athira *et al*., 2018). This is not only for a successful outcome of affected animal, but also to prevent the shedding of the bacteria in order to reduce the risk of transmission to other animals (Whittier and Currin., 2009). Therefore, the present case report describes the successful clinical management of stage II and III IKC using 20% oxytetracycline along with topical eye ointment in goats and a ram, respectively.

Case descriptions

Case 1

A herd of eleven goats of different ages (three young and eight adults) were presented to Kombolcha City Veterinary Clinic on December 1, 2022, with the primary complaint of an eye problem in three of the goats. The presented complaints from the owner were ocular discharge and lesions in the eyes of the affected goats (two adult females and one young male) for the period of the last two days. All the goats were bought one week before the date of admission with an unknown treatment history. The goats were kept together in an extensive outdoor system by grazing and browsing on the pasture. The owner noted that neither mortality nor morbidity had been recorded with a similar sign before, and this was the first time it had occurred. The physical examination showed rectal temperatures of 40 ^{O}C and 40.5 ^{O}C for female goats and male goat, respectively.

The respiratory rate was 16, 18, and 20 beats per minute, and the heart rate was 65, 70, and 85 beats per minute. Upon gentle pinching of the skin, it returns quickly to its position, and capillary refill time was around two seconds.

There were varying degrees of corneal cloudiness (a small gray cloudy area in the centre of the cornea) and hyperaemia of conjunctival tissues in the three goats, along with serious to mucoid ocular discharge that is matted around the eye in only one female goat. Corneal ulcer was noted on the right of one female goat. One eye of two goats (the right eye) and both eyes of one female goat were affected. There were ticks on the head of one goat. The eye was examined thoroughly, and there were no foreign bodies or parasites observed. All the other goats were clinically healthy. Based on the history, clinical signs, and absence of foreign bodies and parasites from the eye, the case was diagnosed as stage II Infectious keratoconjunctivitis (Fig. 12B and C). Clinical management using broad-spectrum antibiotic treatment started by separating the affected goats was arranged and followed until complete recovery was observed.

Figure 12: The eyes of goats affected by IKC. During examinations of the eye (A), a grey cloudy area with corneal ulcer (B), and corneal cloudiness, redness of conjunctiva and ocular discharge which is matted around the eye (C) from the right eye of female goats at day one.

Case management and treatment outcome

In this case, the goats were treated with long-acting oxytetracycline (Herbei Hobe Harmony Pharmaceutical Co. Ltd., China) at a dose of 20 mg/kg body weight IM with a second dose after 48 hours as a broad-spectrum antibiotic.

Oxytetracycline topical eye ointment two times a day for seven days was given to speed up the recovery process of the affected animal, as previously indicated by Pugh and Baird (2012). Furthermore, 1% ivermectine (Herbei Hobe Harmony Pharmaceutical Co. Ltd.), at 0.5 ml per 25 kg, SC, was given to all herds for the treatment of ticks and further weight improvement. Advice to the owner was given to separate the affected goats from the herd and keep them in another house with sun-protective shade.

The progression of clinical symptoms and response to treatment was recorded by contact over a phone call with the owners and by directly visiting the owner's home. On the period when the rectal body temperature became in the normal range, there was no ocular discharge from all three goats at day three of the follow-up. Similarly, after five days, the eye lesions in the male goat improved well (no cloudiness, no reddened appearance).

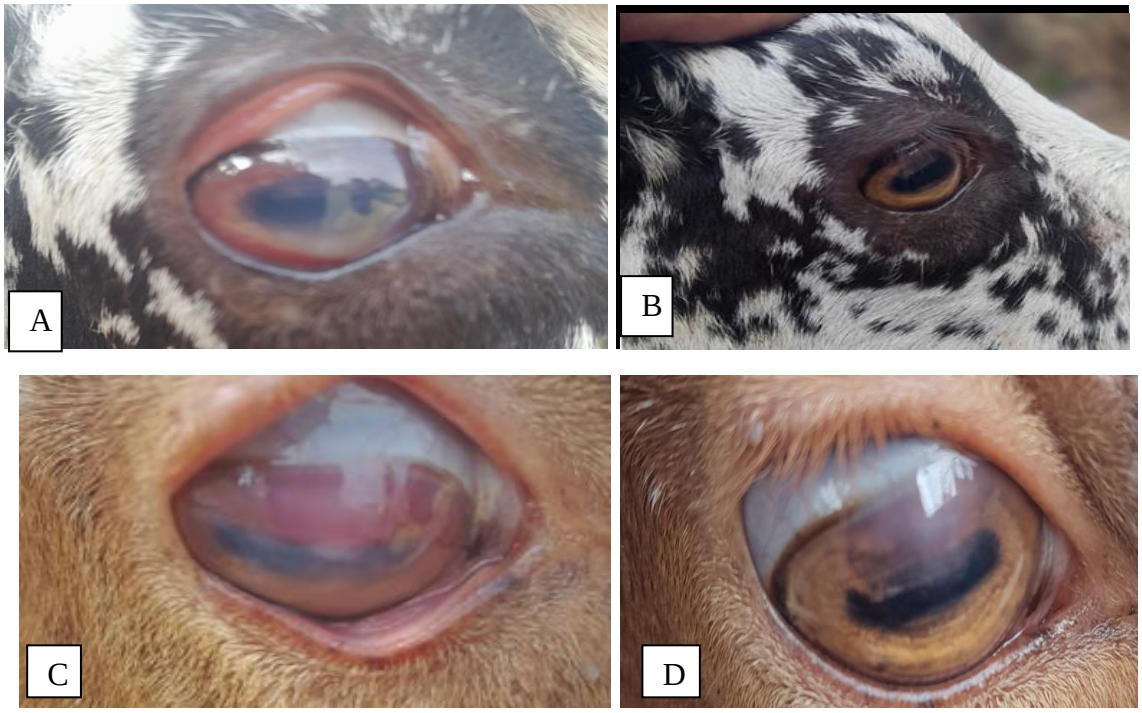

Figure 13: The eyes of goats affected by IKC at the five and twelve days of post treatment. The vascularized outer area of the cornea and attachments of the sclera and cloudiness over the cornea (A and C) at day five and complete (B) and partial (D) disappearance of those lesions at day twelve of the follow-up from the right eye of a female goats.

On the same day, the outer area of the cornea and attachments of the sclera were vascularized, the cloudiness covered large areas of the cornea, and the conjunctival redness was reduced in the two female goats (Fig. 13A and C). One young male goat from the herd also affected by similar symptoms at day four of the follow-up and treated similarly while other goats were in good health throughout the follow up period. No recurrence was occurred during one month follow-up by mobile phone call. During follow-up period the progression of clinical symptoms and time of recovery was differ among each goat in the post treatment periods. For this reason complete recovery (the goat's eyes well again and looked clear) observed within one week in young male goat and two to three weeks in female goats (Fig. 13B and D). The treatment arrangement and prognosis in this case study was outstanding as the goats recovered successfully.

Case 2

A ram with an eye problem was examined at Harbu Veterinary Clinic on February 10, 2023. According to the owner, the ram was brought from another area one month ago and cared extensively. The ram had not received any medication before. Physical examination revealed a body temperature of 39.9 ^{O}C, a respiratory rate of 20 breaths per minute, and a pulse rate of 80 beats per minute. The ram was depressed, and the sight of right eye was affected while the left eye was normal. There was reddened conjunctiva and mucoid ocular discharge (matted on the face). The entire cornea was gray-white with ulceration (Fig. 14 left).

Figure 14: The right eye of a ram affected by IKC before and after treatment (left to right).

Based on history and observed clinical findings, the cause was diagnosed as stage III Infectious keratoconjunctivitis. To rule out the causative agent, an ocular swab was taken and gram staining was performed, and the result showed gram-positive bacteria arranged in a grape-like pattern under 100X microscope, which is the characteristic of the *Staphylococcus* organism.

The ram was allowed to receive treatment in order to assess the effectiveness of the therapy and ensure full recovery and reserved in an intense observation, participating both actively and passively. Accordingly, the ram was treated with long acting oxytetracycline (Chongqing Fangtong Animal Pharmaceutical Co. Ltd., China) IM injections at 20 mg/kg body weight for three days, 48 hrs apart, along with topical application of gentamycine eye ointment daily for seven days. The ram responded to treatment, and a significant improvement in eye conditions including improvement in the vision were observed at a three-week visit during the follow up period (Fig. 14 right). Unhappily, the ram was sold for the local market, and the complete recovery status of the ram was not fully recorded.

Discussion

Infectious keratoconjunctivitis is a contagious bacterial disease of the eye and considered as worldwide disease of sheep and goats (Rahaman *et al*., 2018). This infection will cause the inflammation of the tissue lining the eyelid, the cornea and conjunctiva ultimately causing ulceration which may progress to produce pain and worsen leading to temporary or permanent blindness (Saharee *et al*., 2014). The present case studies describe and report the successful clinical management of IKC in three goats and a ram. In the current case report the animals were purchased one week before date of presentation and in agreement with the description by Kahn and Line (2005) as environment and shipping stress contribute to the development of pinkeye disease. Shipping stress causes immunosuppression in animals, which allows for multiplication of invading bacteria and colonization and disease pathogenesis (Zamri-Saad *et al*., 1994). In these case studies conjunctivitis, lacrimation and different stages of corneal opacity were observed and were similar with those clinical manifestations of pinkeye described by Abdullah *et al*. (2014) and Whittier *et al*. (2009).

Based on the recorded clinical signs the cases were diagnosed at the second and third stages of the disease. This is in agreement with the description of Abdullah *et al*. (2014) and Seid (2019). IKC may affect one or both eyes and increase in rectal body temperature is a common clinical finding in pink eye due to inflammation in the affected eye (Jesse *et al*., 2017), which was also observed in the current cases. In addition, a *Staphylococci* organism was recognized from the eye swab sample of the ram. Similarly, Abdullah *et al*. (2013) found *Staphylococcus aureus* from a dairy cow affected by stage III infectious bovine Keratoconjunctivitis.

The economic impact of the disease is significant due to its contagious nature. Therefore isolation and swift reaction are keys in reducing the spreading of the disease (Seid, 2019). The treatment protocol was clinical management in this case was using antibiotic treatment started by separating the affected animals and followed until complete recovery observed. Oxytetracycline antibiotic treatment by both systemic and topical means have been reported and recommended by many authors (Jesse *et al*., 2017; Pugh and Baird, 2012). Thus, the treatment arrangement and prognosis in the present cases were excellent, as all the affected animals were well again successfully by preventing temporal or permanent blindness with varies complete recovery period that might be due to different in immune status of the affected animals. In conclusion, early report and management of IKC is essential by reducing animal distress and to minimize spread within the group.

3.2.2. Peste des petits ruminants in goats

Abstract

Peste des petits ruminants is an acute, highly contagious, reportable, and economically significant viral disease of sheep and goats that is characterized by high morbidity and mortality. In the current case report, two separate field-based, natural cases of PPR virus infection in goats under one year old were examined in Kombolcha, South Wollo, Ethiopia. The animals were febrile, with a rectal temperature of 40.5 to 41.5 ^{O}C. The clinical indications were varying in both instances. Bilateral ocular and nasal discharge, coughing, diarrhea, caseous necrosis in the mouth, and depression were among the clinical features observed during the clinical examination of the cases.

The cases were diagnosed on the basis of history, clinical features; along with the rapid pen-side test and the capture ELISA methods (case 1). The pneumo-enteritis syndrome case definition was realizes in one of the cases (case 2). Combinations of antibiotics and anti-inflammatory drugs were used to handle the cases. In addition, oral rehydration was used in one of the cases. The goats were recovered from the condition. Therefore, isolation of sick and newly purchased animals from the rest of the animals, and implementing a routine vaccination program are highly acceptable practices for effective control and prevention of the disease. This viewpoint strongly supports the use of rapid pen-side diagnostics.

Key words: *Goats, Pen-side diagnostics, Peste des petits ruminants*

Introduction

Peste des petits ruminants (PPR) is a highly contagious, OIE-reportable, and economically significant transboundary viral disease of sheep and goats caused by the (Balamurugan *et al*., 2014; Wernike *et al*., 2014). According to Dhanasekaran *et al*. (2014), it is also known as ovine rinderpest or goat plague and is often regarded as a more devastating illness in goats than sheep. The PPR virus belongs to the genus Morbillivirus, which belongs to the Paramyxoviridae family (Waret-Szkuta *et al*., 2008). According to Jemberu *et al*. (2022), the virus has been spreading significantly among Ethiopia's small ruminant population. Thus, it has become one of the most economically significant livestock illnesses in the nation (Gopilo, 2005).

According to clinical tests, the disease looks similar to rinderpest in cattle and is characterized by high fever (pyrexia), conjunctivitis, oculo-nasal discharges, necrotizing and erosive stomatitis, diarrhea, and bronchopneumonia, which are followed by either the animal's death or recovery from the illness (Zahur *et al*., 2014). The incubation period can last from two to ten days; however, clinical symptoms typically start to manifest in two to six days (Ahmed, 2020). The virus replicates in the oropharynxes draining lymph nodes during this incubation period, and then it spreads (through blood and lymph) to other tissues including the lungs, causing a primary viral pneumonia (Nanda *et al*., 1996).

Hence, PPR can cause outbreaks of pneumonia. Lesions are not confined to the lungs, but extend to the upper respiratory tract (Benavides *et al*., 2015).

The clinical signs elicited by the virus may vary depending on the breed of the affected animal species and/or the strain of virus (Banyard *et al*., 2010). On the other hand, factors such as the resilience of the population, nutrition, co-infection and other stressors contribute to the pathogenesis of PPRV infection (Roeder and Obi, 1999). However, Animals that recover from PPRV infections develop life-long immunity (Bodjo *et al*., 2006).

According to Kinimi *et al*. (2020), PPRV can be spread through direct contact with infected animals, aerosol exposure, or by coming into contact with lacrimal secretions, nasal exudates, saliva, and feces. Spread via conjunctiva penetration, bedding, feed, and water trough licking, as well as through the milk of an infected dam, is common (Ahmed, 2020).

According to estimates, the mortality rate for exposed animals ranges between 20% and 90%, while the morbidity rate can reach 100% (Jemberu *et al*., 2022). It is reasonable to assume that the large range of reported values will be influenced by variations in the species (sheep or goats), production methods, and degrees of innate or acquired immunity (Wakwaya, 1997).

In sheep and goats, ulcerative to necrotic lesions are visible throughout the buccal cavity after PPRV infection (Parida *et al*., 2015). The dark red areas (congestion) in different lobes of the lungs and in the small and large intestines were documented by Ahmad *et al*. (2005). Necrosis, erosions, and ulcerations of the epithelial layers of the labium, the vulva, and the alimentary tract as well as giant-cell type pneumonia were among the pathological abnormalities reported in natural PPR infections (Obi *et al*., 1983).

To develop a preliminary diagnosis of PPR, clinical observations, distinguishing symptoms, epidemiology, and post-mortem lesions are used (Balamurugan *et al*., 2014).

Since, PPRV infections share a clinical profile with other illnesses such as bluetongue, infectious caprine pleuropneumonia, capripox, and foot-and-mouth disease, a definite laboratory diagnosis of PPR is essential to getting an accurate result (Banyard *et al*., 2010).

Thus, the provision of simple, low-cost laboratory-based assays, including pen-side diagnostics, would aid in PPR prevention and control in low-income countries (OIE, 2018). Live animals may be used to collect samples for the diagnosis of PPR from swabs from conjunctival discharges or from the nasal, buccal, or rectal mucosa. Whole blood is also obtained in anticoagulant at the very beginning of the illness for virus isolation, PCR, and haematology (OIE, 2022).

Although there is no specific treatment for PPR, mortality can be reduced by employing medications that manage bacterial complications (Islam *et al*., 2012). As a result, vaccination is critical in the control of PPR (Roth, 2011). This case report describes two separate cases of peste des petits ruminants in young goats.

Case descriptions

Case one

The owner brought a four-year-old doe with her two three-month-old kids to the Kombolcha City Administration Veterinary Clinic on November 15, 2022. The history of the case was lacrimation, nasal discharge, coughing, and reduced feed intake from the kids for three days. The goats were kept extensively, and the kids were fed breast milk. On clinical examination, the kids were febrile, with body temperatures of 41 ^{O}C and 41.5 ^{O}C, pulse rates of 100 and 120 beats/min, and respiratory rates of 20 and 24 breaths/min. There were bilateral ocular discharges that stained the facial hair, reddening of the conjunctiva, and the cornea was cloudy (Fig. 15B and C). There was dried nasal discharge at the tip of the nostrils. On examination of the doe, the rectal body temperature, respiratory rate, and pulse rate were in the normal range, but there were ulcerative lesions on the lips.

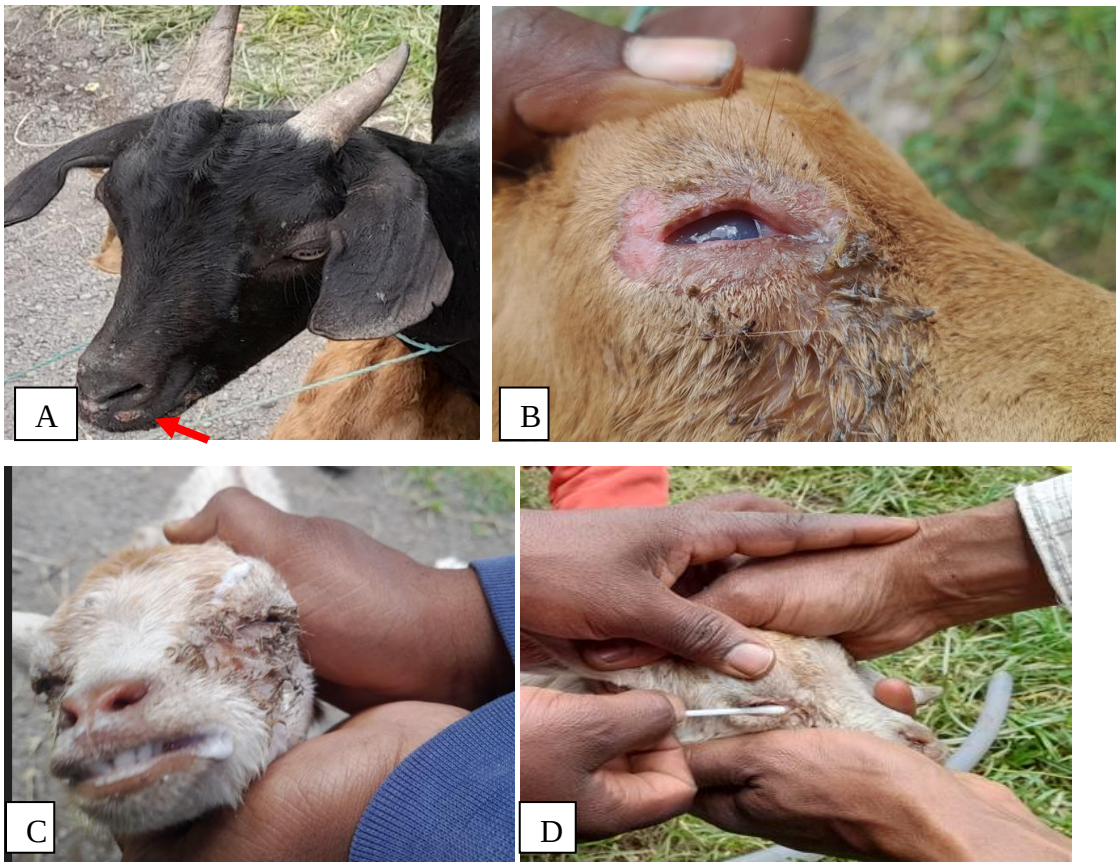

Figure 15: Indicating the doe and kids affected by PPR. Ulcerative lesions on the upper lip of the doe (A), ocular discharge matted on the face and corneal cloudiness of the eye (B and C), and during taking ocular swab sample (D).

Case two

A yearling afar breed male goat was examined at Kombolcha City Administration Veterinary Clinic on December 21, 2022, with a history of reduced feed intake, nasal discharge, and coughing since two days before the date of examination. The owner also added that the goats were purchased from Bati woreda before one week and kept intensively together with the other five goats. During physical examination, the goat was depressed (Fig. 16A) and febrile, with the rectal body temperature reaching 41.3 ^{O}C. The respiratory and heart rates were 24 breaths per minute and 96 beats per minute, respectively. There was mucopurulent nasal discharge (Fig. 16 D), ulcerative lesions in the epithelium of the mouth, tongue, and both gums with a cheese-like coating on the epitheliums (Fig. 16B), and reddening of the conjunctiva.

Coughing was noticed during the examination. The goat was soiled with feces from the perineum (Fig. 16C), and there was resistance to touching the mouth (arising from pain).

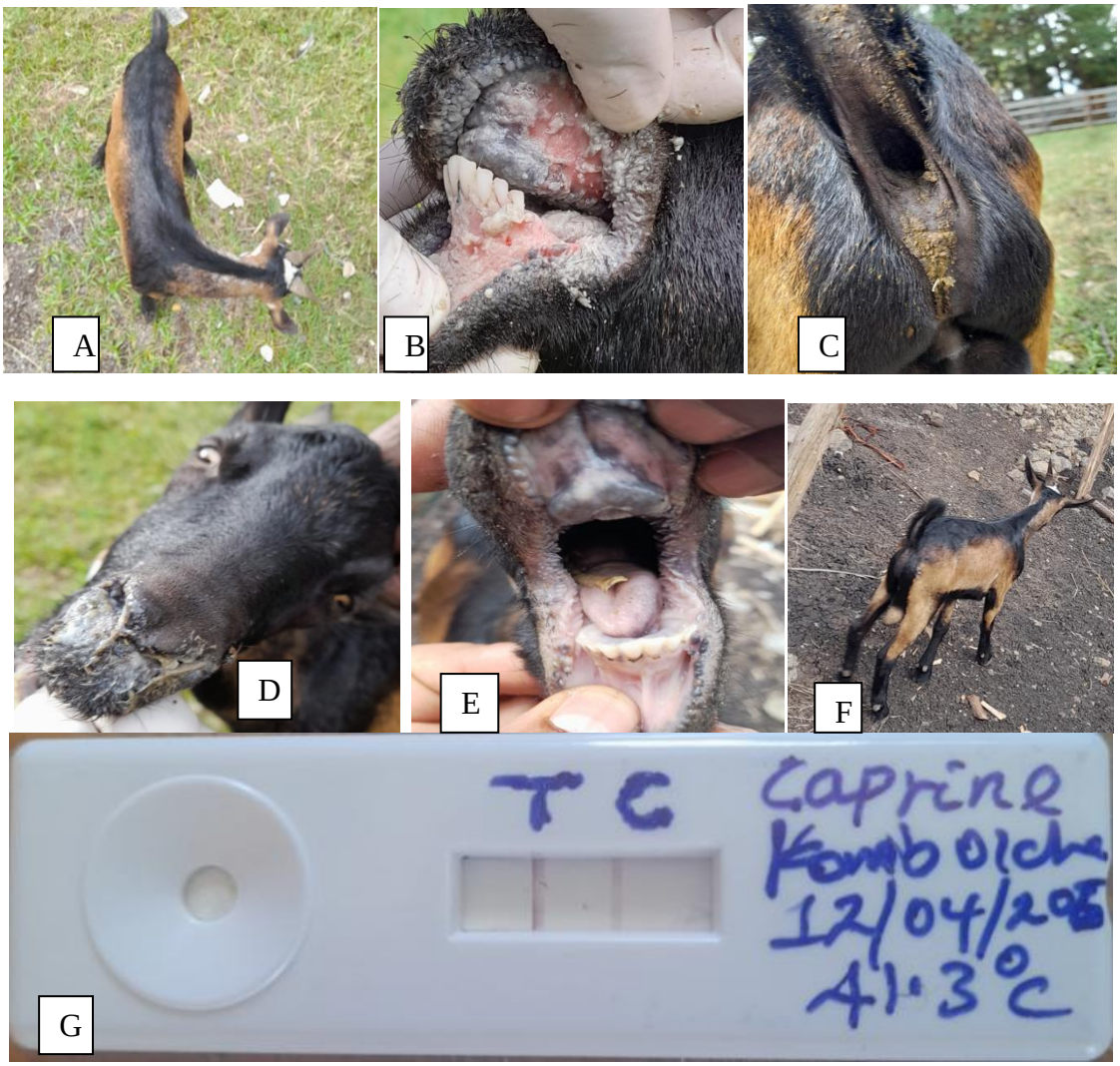

Figure 16: Characteristic clinical signs of PPR in yearling goat before and after treatment. A goat with depression (A), ulcerative lesions with pale and grey areas of dead cells on both upper and lower gums (B), feces from the perineum (C), and mucopurulent nasal discharge (D) at day one. The status of the goat at day four of the follow-up (E and F) and the rapid pen side test result (G).

On the basis of history, clinical signs and realization of the pneumo-enteritis syndrome case definition (case 2) both the two cases were tentatively diagnosed as Peste des petites ruminitis.

Laboratory investigation and findings

The cases were reported to the livestock and fisheries sector development project, Kombolcha branch office. The cases were then diagnosed by a rapid pen-side test using a PPR rapid diagnostic kit. The test detects PPR viral antigen on a naso-ocular swab. Thus, the conjunctiva inside the third and lower eyelid and nasal cavity were rubbed using the kit-provided sterile swab with taking care not to touch the eye. Then the swab was immediately placed into the plastic vial with 30 drops of buffer and agitated in the buffer. The test device was removed and placed horizontally. Four drops of the test sample were applied to the sample hole of the test device and checked for the development of colour after 20 minutes in the test (T) and control (C) lines. Finally, the rapid test yielded a positive result, shown as a vague test (T) line (case 1), a clearly visible test (T) line (case 2), and a clear control (C) line (cases 1 and 2). Therefore, the rapid pen-side test results accurately indicated the presence of PPR virus antigen in the sample taken and were interpreted and confirmed as positive for the PPR virus, which causes PPR. The pen-side test result is indicated in Figure 16G (case 2). In addition, the same samples from animlas in case 1 were sent to the Animal Health Institute of Ethiopia for further confirmations. Accordingly, the capture ELISA result showed the presence of PPRV antigen.

Case management and treatment outcome

Since it is a viral disease, there is no specific treatment for PPR, and treatment was given with the aim of preventing secondary bacterial complications. Thus, long-acting oxytetracycline (Herbei Hobe Harmony Pharmaceutical Co. Ltd., China) at a dose of 20 mg/kg body weight, IM, for two days with the second dose after 48 hrs along with topical eye ointment once daily for five days was given in Case 1 of the cases. Dexamethasone sodium phosphate at 0.2mg/ keg was also given as an anti-pain medication. The doe and kids recovered well from the problem, as the owner reported by phone call. Correspondingly, for animals described in Case 2, Sulphamethoxazole-Trimethoprime (Chengdu Qiankun Veterinary Pharmaceuticals Co., Ltd., China) IM, at a rate of 1 ml per 16 kg of body weight was given for three successive days.

Diclofenac sodium was used with the aim to reduce the fever and pain. In addition, the owner was instructed to give 500 ml oral rehydration fluid (homemade from six tea spoons of sugar, half a tea spoon of salt, and one litter of water) per day for 2 days as described by FAO (1994) with access to plenty of fresh water.

The purulent and cheesy materials were removed and sanitized with 1% iodine. During the follow-up period after one day of treatment, the feed-intake improved and the rectal body temperature returned to normal. The owner responded that diarrhea was stopped on the next day of treatment and nasal discharge was reduced after three days of post-treatment. On the fourth day after treatment, the cheesy material and nasal discharge were completely removed, and the oral lesions were fully recovered except for a small ulcer present on the right lower gum. The condition of the goat at day four of the follow-up period is indicated in Figure 16E and F. Based, on the owner response by phone call full recovery was observed at ten days of post treatment. Moreover, vaccination was given to sheep and goats, including those that reside in the surrounding area, which was arranged by Kombolcha Animal Diseases Survey, Investigation, and Diagnostic Laboratory and Livestock and Fisheries Resource Development Office of the area. An example of a vaccination campaign against the PPR virus at Harbu Veterinary Clinic, Kalu Woreda, is shown in Annex 3.

Discussion

In the current case report, two field-based, natural cases of PPR virus infection in goats were investigated in Kombolcha, South Wollo, Ethiopia. The clinical disease is acute, with pyrexia up to 41°C that can last for 3-5 days (Zahur *et al*., 2014); the animals become depressed and anorexic. Serous oculo-nasal discharges become progressively mucopurulent. Within 4 days of the onset of fever, the gums become hyperaemic, and erosive lesions develop in the oral cavity. These lesions may become necrotic. Watery, blood-stained diarrhea is common in the later stage, and coughing also occurs (OIE, 2018). These clinical signs were in agreement with the present case studies. Clinical signs of PPR, in chronological order, are the sudden onset of pyrexia, necrosis and erosions of the oral cavity, diarrhea, and pneumonia, as observed in goats by Obi *et al*. (1983). This is strongly consistent with the clinical sign observed in case 2 of the current case report.

In addition, the clinical signs and lesion distribution in the present case report highly met the description of the *pneumo-enteritis* syndrome case definition and are indicative of a field diagnosis. As a result of the PPR epidemic in a goat flock in Pakistan, severe diarrhea, breathing problems, mucopurulent discharge from the eyes and nose, caseous necrosis in the mouth, fever, and depression were all documented (Ahmad *et al*., 2005).

The sign of corneal cloudiness and conjunctivitis seen in case 1 of the present cases might be due to secondary bacterial complications after PPR infection as documented by Rahaman *et al*. (2018). In these case studies, the animals recovered well after treatment. However, the cost of treatment and related economic losses affects the farmer's profit. On the other hand, the severity of disease depends on the immune status of the animal; for example, animals under a year old particularly newborn animals become susceptible to PPRV infection at three to four months of age (Abubakar *et al*., 2008; Kinimi *et al*., 2020). This is explained by the fact that at this period, any pre-existing maternal antibody levels begin to decline. In keeping with this view, these case studies present the case of PPR in goats less than one year of age (one case in three-month-old kids). Thus, early and accurate identification of PPRV infection is essential for control, and this can be assisted by pen-side tests.

In live animals, swabs are made of the conjunctival discharges and from the nasal and buccal mucosa, which can be used for diagnosis (OIE, 2018). Similarly, in this case report, PPR viral antigen was detected from occulo-nasal swab and finally the cases were confirmed by rapid pen side tests along with tentative diagnosis based on the suggestive clinical features and disease epidemiology.

In the current report, free animal movement was noticed, which might be a source of disease spreading from one area to another. This makes PPR looked upon as a major large-scale concern due to the uncontrolled movement of animals through trade along with its highly contagious nature (Parida *et al*., 2015). Therefore, for proper controlling and prevention of the disease, strict animal movement control is supposed to be a useful tool. In addition, the isolation of sick and newly purchased animals from the rest of the animals and implementing a routine vaccination program are extremely acceptable. In this view, the use of rapid pen side diagnostics is highly warranted.

3.2.3. Colibacillosis in twenty day old kid

Abstract

Colibacilosis is one etiologic diagnosis commonly applied to goat kids with diarrheal disease. The current case report describes the diagnosis of Colibacillosis in a twenty-day-old female kid in Kombolcha City Administration Veterinary Clinic, South Wollo, Ethiopia. The chief complaints were reduced interest in sucking milk and voiding of very soft faces that sometimes mixed with blood starting two days prior to presentation. Clinical physical examination revealed that the kid was soiled with fecal material around the perineum and tail, was weakened and depressed. The rectal temperature of the kid was 40.2 ^{O}C, the heart rate and respiratory rate were 120 beats per minute and 56 breaths per minute, respectively, and the conjunctival mucous membranes were congested. The bacteriological examination on the fecal sample confirmed the presence of *E. coli*. Therefore, based on the history obtained, clinical signs observed and laboratory finding the case was finally diagnosed as Colibacilosis. Treatments with sulphamethoxazole-trimethoprime (Chengdu Qiankun Veterinary Pharmaceuticals Co. Ltd.), IM at a dose of 1ml/16kg body weight and dexamethasone sodium phosphate were arranged. But the kid was not recovered and died after 12 hrs of presentation. In conclusion, the present case study shows as *E. coli* were detected in kid with diarrhea. This then indicated as diarrhoea due to Colibacillosis is an economically important health problem in goat kid and results in reduced replacement stocks in the goat population. Therefore, proper management and early treatment of this disease are crucial for maintaining a stable and profitable goat population.

Key words: *Colibacilosis, Diarrhea, E. coli, treatment*

Introduction

Goat farming is good source of income and employment especially in adverse environments (Sharma *et al*., 2020). For this reason, among the livestock population, goats are known as the poor person's bank or the poor family's insurance policy and are distributed mainly to landless and marginal farmers (Begum *et al*., 2016).

Similarly, Ethiopia is home to diverse goat genetic resources from diverse ecologies and production systems (Tekle, 2014). However, goats are affected by many infectious and parasitic diseases (Shiferaw *et al*., 2006) that adversely reduce the productivity of goats, especially due to the mortality of kids (Debele *et al*., 2013a). Among diseases of goat, diarrhea is considered common gut associated illness (Islam *et al*., 2016).

There are various causes of diarrhea including bacterial, viral, parasites, and diet (Rajput *et al*., 2014). It is also common in newborn kids, including calves and lambs (Aklilu *et al*., 2013). E. coli was the most frequent bacterial species identified as the cause of neonatal mortality in lambs and kids and represented 63.4% of all bacterial isolates (Sharif *et al*., 2005). Infection with E. coli, called Colibacillosis, takes many forms, some of them septicaemia, some toxaemic due to absorption of the enterotoxin, and some locally toxigenic (Rajput *et al*., 2014). Colibacillosis is common diarrheal disease in kids, leading to morbidity and mortality (Ma, 2014). Thus, it is an economically important disease of goat kids (Sharma *et al*., 2020) due to the heavy death toll (Vihan, 1993). Generally, systemic infection of *E. coli* in kids results in septicaemia and enteritis, characterized by fever, anorexia, and general weakness (Abdullah *et al*., 2010), diarrhea, loss of appetite and followed by coma and death (Ahmed *et al*., 2013).

In nature, *E. coli* is widely dispersed and can be found in soil, surface water, animal, and human feces (Jesse *et al*., 2016). Moreover, *E. coli* is gram-negative, rod-shaped bacteria that conform to the definition of the family Enterobacteriaceae (Mohammed *et al*., 2014). Under laboratory conditions, *E. coli* cells can easily grow on a common solid or in a liquid growth media like nutrient agar, MacConkey agar, or eosin methylene blue agar (Basavaraju and Gunashree, 2022). The bacteria grow readily on most laboratory media at 15 ^{O}C to 45 ^{O}C, the optimum temperature being 37 ^{O}C (Mohammed *et al*., 2014).

Antibiotics are used in cases of diseased animals in the treatment of diarrhea (Nazir, 2004). However, these treatments are generally ineffective, due in part to the presence of drug-resistant strains of microorganisms (Vihan, 1993).

Incomplete treatment course and continuous indiscriminate use of antibacterial agents against diarrheal infections might have subjective to the production of resistant bacteria (Begum *et al*., 2016). On the other hand, the resistance might be associated with close human-animal interfaces through environmental cross contamination (Rashid *et al*., 2015). The current case report describes the diagnosis of Colibacillosis in a twenty-day-old female kid with diarrhea in Kombolcha, South Wollo, Ethiopia.

Case presentation and description

A twenty-day-old female local breed kid was presented to the Kombolcha City Administration Veterinary Clinic, Kombolcha, South Wollo, Ethiopia, on November 24, 2022, with chief complaints of reduced interest in sucking milk and voiding of very soft faces that sometimes mixed with blood starting two days prior to presentation. The owner mentioned that the kid was kept intensively separated from her mother during the day, and milking is only done during the night. Physical examination revealed that the kid was soiled with greenish fecal material around the perineum and tail (that indicate diarrhea), was weakened, and depressed (Fig. 17). The rectal temperature was 40.2 ^{O}C, the heart and respiratory rates were 120 beats per minute and 56 breaths per minute, respectively, and the conjunctival mucous membranes were congested.

Figure 17: Indicating diarrhea in kid due to Colibacillosis. A depressed kid (left) soiled around the perineum and tail (right).

Based on history and clinical signs, the cause was tentatively diagnosed as Colibacillosis, although Salmonellosis, Coccidiosis, Corona, and Rotavirus were well thought out as a differential diagnosis.

Laboratory finding and its investigation

A fecal sample was collected from the kid directly from the rectum using fingers for parasitological examination of the presence of parasitic egg. It was also taken by swab and transported with bacterial transport medium for bacterial examination. The samples were aseptically collected in a sterile labelled specimen container and submitted and immediately processed at microbiology and parasitological units of Kombolcha Animal Disease Survey, Investigation and Diagnostic Laboratory. For parasitological examination, a fecal floatation technique (Annex 4) was performed for the detection of parasitic egg and but the result was negative.

For bacterial examination: Sample was enriched with Tryptone soya broth incubated at 37 ^{O}C for 24hrs. The enriched fecal sample was cultured at 37 ^{O}C for 24hrs on MacConkey agar which is selective for gram negative and enteric bacteria and differential medium for them based on lactose fermentation. Accordingly circular, red and lactose fermenting bacteria were observed (Annex 6) which is the characteristic of *E. coli*. For the isolation and identification of E. coli the growths from the MacConkey agar selective medium for were harvested and sub cultured on nutrient agar medium and eosin methylene blue (EMB) agar medium, incubated at 37 ^{O}C for 24hrs. On the next day metallic sheath characteristics of E. coli was observed on EMB (Annex 6). Gram staining techniques was performed from the pure culture on the nutrient agar and gram negative rod shaped bacteria were observed. Furthermore, oxidase, triple sugar iron, indole, citrate and methyl red tests were performed. Thus, all the bacteriological test result and gram staining technique on the sample confirmed the presence of the bacteria *E. coli* from the fecal sample. Therefore, based on the history obtained, clinical signs observed and laboratory findings the case was finally diagnosed as Colibacillosis.

Case management and treatment outcome

In this case study treatment with antibiotic and anti inflammatory drug were arranged. Accordingly, Sulphamethoxazole-Trimethoprime (Chengdu Qiankun Veterinary Pharmaceuticals Co. Ltd.), IM at a dose of 1ml/16 kg body weight and dexamethasone sodium phosphate at 0.2 mg/kg were administered at the first day. But the kid was not recovered and died after 12 hrs of presentation.

Discussion

Colibacillosis is one etiologic diagnosis commonly applied to goat kids with diarrheal disease (Cid *et al*., 1996). *E. coli* is the leading causes of bacterial diarrhea in animals and causes mortality in kids and lambs (Ma, 2014) especially susceptible during the first week of life (Cid *et al*., 1996). In the present case study, *E. coli* was identified from twenty day old female kid with diarrhea. This is in agreement with similar findings reported by Begum *et al*. (2016) and Chakrabarti and Singh (2022). Moreover, the diarrhea was explained by dehydration, weakness and death of the kid. This is in agreement with the comparable findings reported by Debele *et al*. (2013a).

The diagnosis of the case was based on the clinical sign and identification of the bacteria from the fecal samples. The bacteriological result from the fecal sample indicates the presence of gram negative rod shaped organism. The colony characteristics on MacConkey agar and eosin methylene blue agar indicated that the bacterium was *E. coli* which was supported by the similar findings of Abdullah *et al*., (2010).

E. coli has developed a wide range of antimicrobial resistance and the incidence of multiple antibiotic resistant *E. coli* strains has been growing (Begum *et al*., 2016). In this case study the kid was not responded to treatment and died while under handling. This might be associated with development of antimicrobial resistance due to wide used of antibiotic drugs, incomplete course of treatment and continuous indiscriminate drug use, and cross contamination (Vihan, 1993; Nazir, 2004; Rashid *et al*., 2015; Begum *et al*., 2016). Thus, it is important to know the antibiogram profiles of a given antibiotics before used in the treatment of diarrhea cased by *E. coli*. On the other hand, death can be due to microbial origin.

In this view, death in kid due to suffering from Colibacillosis was previously reported by (Sahoo *et al*., 2015). In conclusion, the present case study shows as *E. coli* was detected in kid with diarrhea. Therefore, diarrhoea due to Colibacillosis is an economically important health problem in goat kids and results in a reduced number of viable replacement stocks in the goat population, which in turn affects the farmer's profit.

3.2.4. Coenurosis in a kid

Abstract

Coenurosis is a parasite disease of small ruminants caused by *Coenurus cerebralis*, which is the immature form of *Taenia multiceps*. This case report presents the clinical feature and post-mortem findings of Coenurosis in a 5-month-old kid examined at Kombolcha City Administration Veterinary Clinic, South Wollo, Ethiopia. The owner mentioned that the kid had been showing incoordination since two days before. The kid had received oxytetracycline by intramuscular injection before. The kid was kept semi-intensively with other two goats and fed grass and plant shrubs. The owner had also kept one dog in his compound. Clinical physical examination revealed circling movement to the right, an unstable gait, and extension of limbs. The temperature was 39.9 ^{O}C, the heart rate was 72 beats per minute, the respiratory rate was 28 breaths per minute, and there was mild congestion of ocular mucous membrane. The kid was died after 18 hours without responding to treatment. The skull opened and brain was examined for the presence of cysts. Accordingly, thin walled translucent cyst filled with fluid was observed in the left cerebral hemisphere of the brain. Finally, based on the history, typical clinical signs, and the cerebral cyst observed, the case was diagnosed as Coenurosis. In conclusion, this case study revealed the close interactions between the definitive host (dog) and intermediate host (goats) may favour the transmission of Coenurosis. Thus, awareness on the source and the mode of transmission is very significant in the management of the disease.

Key words: *Coenurosis, cyst, kid*

Introduction

Coenurosis is a parasite illness of ruminants caused by *Coenurus cerebralis*, which is the immature form of *Taenia multiceps*, a cestoid whose adult form parasitizes the dog and other carnivores (Navarro *et al*., 2006). It is also called "GID" or sturdy (Adane *et al*., 2015). The adult *Taenia multiceps* cause fatal disease in production animals (Junior *et al*., 2021) and particularly affect sheep and goats (Miran *et al*., 2015). Coenurosis mainly causes great economic damage by infecting small horned animals under one year of age. That is, it has a negative impact on the development of the national economy through the cost of veterinary and sanitary measures against the disease, a sharp decline in the productivity, and the death of infected animals (Arziev *et al*., 2021). Coenurosis occurs in worldwide and it is endemic in Ethiopia, principally in the highland area where sheep population is high (Abera *et al*., 2016).

The disease is transmitted by predators mainly to dogs (Arziev *et al*., 2021). Its adult form (*Taenia*) lodges in the small intestine of canids and can infect several intermediate hosts (Junior *et al*., 2021) while larvae are found in the brain and spinal cord of intermediate hosts (Abera *et al*., 2016). When dog consume the brain containing Coenurus cyst, cyst develop into *Taenia multiceps* and then start to pass proglottid containing egg on pasture (Abera *et al*., 2016). The intermediate hosts acquire infection by ingestion of food or water contaminated with dog faeces containing the eggs (Godara *et al*., 2011). Then reach intestine where oncospheres are released. Thereafter, they are carried in blood to migrate to the brain and spinal cord (the most common sites of infection), and intramuscular and subcutaneous tissues (Sharma and Chauhan, 2006).

The clinical signs of the disease develop when the central nervous system of the affected animal is invaded by C. cerebralis cyst (Miran *et al*., 2015). In addition, the clinical syndrome is determined by the location and size of the Coenurus cyst (Avcioglu *et al*., 2012), number of the cyst in the CNS (Oryan *et al*., 2014), and based on species of animal (Sharma and Chauhan, 2006). It presents as a slowly progressive focal lesion of the brain typically involving the cerebral hemisphere (Adane *et al*., 2015). Young sheep and goats aged 6-8 weeks are most likely to show signs of acute disease which associated with an inflammatory and allergic reaction (Miran *et al*., 2015).

Moreover, the long incubation period for cyst development might have led the clinical disease to occur after three months of age (Sharma and Chauhan, 2006).

The initial signs are often behavioural, with the affected animal tending to stand apart from the flock and react gradually to external stimuli. As the cysts grows, the clinical signs progress to depression, unilateral blindness, circling, altered head position, in coordination, paralysis and recumbency (Adane *et al*., 2015). Major clinical signs in goats and sheep include dullness, circling, torticollis, loss of appetite, frequent bleating, pain response on pressure over the cystic area and sometimes unilateral partial blindness correlated cystic presence in cerebrum with depression, tilting of the head either towards right or left, head pressing, feet stamping or walking in straight line (Sharma and Chauhan, 2006).

The diagnosis of Coenurosis is challenging due to the presence of other similar clinical conditions (Sharma and Chauhan, 2006). The interpretation of clinical signs combined with accurate localization of the cyst using diagnostic imaging is recognized as the best diagnostic method (Oryan *et al*., 2014). In most cases, confirmatory diagnosis is based on exploritative surgery or post-mortem examinations in goats (Godara *et al*., 2011). The differential diagnosis of Coenurosis includes Listeriosis, Nasal bots syndrome, Scrapie, Sarcocystosis, brain abscessation, Polioencephalomalacia, and cerebral echinococcosis (Scott, 2012). Once the clinical syndrome of Coenurosis has been established, the prognosis is bad as the outcome is typically death (Ahmed and Ali, 1972). Therefore, this case report describes the clinical occurrence of the case of Coenurosis in five month old goat kid in Kombolcha, South Wollo, Ethiopia.

Case description

A 5-month-old goat kid was examined on January 25, 2023, in the Kombolcha City Veterinary Clinic, South Wollo, Ethiopia, because of neurological signs and reduced feed intake. The owner mentioned that the kid had been showing abnormal movement and behaviour since two days before. The kid had received oxytetracycline by intramuscular injection from one of the veterinary clinics before one day. The kid was kept semi-intensively with other two goats and fed grass and plant shrubs.

The owner had also kept one dog in his compound. Both the other goats and the dog were healthy. Clinical physical examination revealed circling movement to the right, an unstable gait, recumbency and extension of limbs. The body temperature was 39.9 ^{O}C, the heart rate was 72 beats per minute, the respiratory rate was 28 breaths per minute, and there was mild congestion of ocular mucous membrane.

Based on history and typical clinical signs observed, the case was tentatively diagnosed as Coenurosis with a poor prognosis due to a 100% case fatality rate once the clinical syndrome is recognized and equal consideration is given as the case would probably be its differential diagnosis, Listeriosis. As a result, treatment was established with the sole goal of targeting Listeriosis by continuing the previous treatment. The clinical indications of the case are presented in the Figure 18.

Figure 18: Clinical case of Coenurosis in five month old kid. Showing the kid in circling movement (A), extension of the neck and limbs (B), lateral recumbency towards the right (C), and a translucent *C. cerebralis* cyst (D).

Case management and treatment outcome

Short-acting oxytetracycline (Herbei Hobe Harmony Pharmaceutical Co. Ltd., China) at a dose of 10 mg/kg body weight IM, for three successive days was arranged. Also, the owner was informed to make a mobile phone call if treatment fails and death happens. Based on that, the owner responded because the treatment was unsuccessful and the kid died after 18 hours. Once receiving the death information, the head of the kid was collected from the owner, and the skin was removed, followed by a careful opening of the skull. The brain was examined for the presence of cysts. Accordingly, thin walled translucent cyst filled with fluid was observed in the left cerebral hemisphere of the brain (Fig. 18D). Finally, based on the history, typical clinical signs, and the cerebral cyst observed, the case was diagnosed as Coenurosis. The owner was advised to cook the meat of the kid before giving it to his dog and to always isolate the dog from his sheep and goat.

Discussion

In Coenurosis, neurologic signs were circling and behavioural changes in the affected goat (Nourani and Pirali, 2009). In the majority of cases, such neurological signs result in the death of the affected animals (Oryan *et al*., 2014). Similarly, in this case report typical clinical signs like circling, lateral head deviation, change in gait and macroscopic findings of cerebral cyst were detected. Hence, nervous lesions, due to presence of cysts, lead to neurological symptoms (Sharma and Chauhan, 2006). These signs guide the clinical diagnosis of Coenurosis (Junior *et al*., 2021). In addition, death was observed in the present case that could be as a result of encephalitis and starvation (Anwar *et al*., 2013; Varcasia *et al*., 2022). Therefore, Coenurosis have to be considered as a differential diagnosis in diseases with neurologic signs in goat.

In this report single cyst was isolated in infected kid. However, in literature there was report of more than one cyst from different locations (Manunta *et al*., 2012; Varcasia *et al*., 2015). Animals with such cysts frequently tilt their heads towards the side of the cyst and/or circle to that direction (Ozkan *et al*., 2011).

Furthermore, this tendency to circle towards the side of superficial cysts and but away from the side of more deeply sited cysts (Scott, 2012). In this case study the kid turns the head towards the right that means away from the side of the cyst.

The clinical syndrome of the disease is based on location and size of the cyst in the brain (Avcioglu *et al*., 2012). In this case study the cyst was observed in the left cerebral hemisphere of the brain but Nourani and Pirali, (2009) observed the cyst from the right cerebral hemisphere in goat. On the other hand, Miran *et al*., (2015) found the cysts both in the right and left hemisphere and they suggest about equal chances of the cyst to develop at any site of the brain. This variation could be either of genetic variability of *Taenia multiceps* or of anatomic difference within breeds (Adane *et al*., 2015). In conclusion, this case study revealed the close interactions between the definitive host (dog) and intermediate host (the kid) that is one of key factors in the transmission of Coenurosis. Thus, awareness on the source and mode of transmission is very significant in the management of the disease.

3.2.5. Dystocia due to lateral head deviation and forelimb flexion of dead fetus in doe.

Abstract

Dystocia is one of the most important reproductive problems that results in peri-natal death of dam and newborns in small ruminants. The present report describes the management of dystocia in goat due to left lateral deviation of the fetal head and backward flexion of the forelimbs. A full-term pregnant goat in its first pregnancy was examined at the Harbu Veterinary Clinic, South Wollo, Ethiopia on February 7 2023. The main complaint was anorexia and continuous straining without giving birth for the last 15 hours. On physical examination, the rectal body temperature, respiratory rate, and heart rate were within the normal range. The vulva and the udder were enlarged, and there was a distended abdomen. The goat was depressed but restless and showed continuous straining. The birth canal was completely dilated, and the left ear of the fetus was visible from the outside of the vagina. On examination of the fetus, dead fetus was revealed based on the absence of reflex on pinching. The fetus was found to have normal presentation and position but abnormal posture.

Therefore, based on history and after physical and visual examination, the case was diagnosed as dystocia due to left lateral deviation of the fetal head and backward flexion of the forelimbs. The case was managed by providing lubrication, manual correction by repulsion and traction, and broad-spectrum antibiotic therapy to prevent secondary complications and save the goat's life. Additionally, the goat was treated with dexamethasone and multivitamin injections. The goat was recovered successfully. In conclusion, this case report indicated the clinical incident dystocia due to lateral deviation of the head and flexion of the forelimbs and its successful management by manual correction and traction in goat. Therefore, it is crucial to make a proper diagnosis of the reasons for dystocia before performing any obstetrical procedures.

Key words: *Dystocia, Goat, Traction*

Introduction

Small ruminant production is essential because it is simple to handle, requires few initial inputs, and has a short generation interval (Debele *et al*., 2013b). Additionally, farmers favour raising goats due to their low production costs, ability to adapt to hot environments through dynamic feeding behaviour, fast growth and reproductive cycles (Tsegaye, 2013). Conversely, the contributions of the subsector both to the national or household level were found to be limited and below their potential (Asresie *et al*., 2015). This is due to existing diseases, poor nutrition, reproductive inefficiency, poor animal production systems, management constraints and general inadequate veterinary care (Tifashe *et al*., 2017). Along with these things to keep in mind, reproductive problems in sheep and goats result in lower yield, which affects the survival of threatened species (Gojam and Tulu, 2020). Above and beyond, kid and lamb morality is a major factor in decreased productivity (Sharif *et al*., 2005) and reproductive performance as measured by the number of weaned animals annually, which has an impact on profitability, causing economic loss to farmers (Mukasa-Mugerwa *et al*., 2000).

Dystocia is one of the most important reproductive problem that cause peri-natal death of dam and newborns in small ruminants including goats (Ahmed *et al*., 2019) due to damage of the birth canal and excessive use of traction forces (Pandey *et al*., 2018).

Dystocia is condition occurs when an animal fails to gives birth at the moment of parturition and required human intervention (Malik *et al.,* 2019). It typically develops when the first or second stages of parturition are postponed or when the first stage fails to advance to the next stage within 30 minutes (Sharma *et al*., 2014; Pandey *et al*., 2018).

In small ruminant dystocia can be brought on by either maternal or fetal causes (Singh *et al*., 2017). The most frequent fetal causes of dystocia were fetal abnormalities, breech presentation, head deviation, and forelimb flexion (Ismail, 2017). Head lateral deviation and bending of the carpal and shoulder joints are the commonest fetal causes of dystocia in sheep and goats, followed by relative fetal enlargement (Purohit, 2006). So, it was thought that the main causes of dystocia were fetal maldispositions (Ahmed *et al*., 2019). On the other hand, the majority of maternal causes were linked to failure of cervical dilatation (Ismail, 2017), followed by uterine inertia (Purohit, 2006), and over feeding of dam during pregnancy (Malik *et al*., 2019). Moreover, fetal death in domestic animals occurs in the middle or third of the gestation without luteolysis and abortion of the fetus but rather is followed by autolytic alterations in the fetus, absorption of placental and fetal fluids, involution of the maternal placenta, and mummification of the fetus (Bisla *et al*., 2018).

Dystocia in goats can be identified using the case history, physical examination (Purohit, 2006), and radiographic or ultrasonographic examination for a more thorough diagnosis that includes the position and postures of foetuses (Jackson, 2004). The application of these diagnostic tools in the field is now constrained by the scarcity of such diagnostic aids, a lack of adequately qualified workers, and clients' inability to pay costs (Ogbu *et al*., 2011). Furthermore, cases of dystocia can be managed medically or surgically (Abdullah *et al*., 2015b). However, the first stage in treating dystocia for the veterinary staff is to be able to distinguish the kidding and lambing complications (Ali, 2011). Any delay in third-party intervention worsens the likelihood of both maternal and fetal losses (Malik *et al*., 2019). This clinical case report describes the management of fetal dystocia in goat due to left lateral deviation of the fetal head and backward flexion of the forelimbs.

Case description

The owner presented his 18-month-old full-term pregnant goat in its first pregnancy to Harbu Veterinary Clinic, South Wollo, Ethiopia on February 7 2023. The main complaint was anorexia and continuous straining without giving birth for the last 15 hrs. On physical examination, the rectal body temperature, respiratory rate, and heart rate were within the normal range. The vulva and the udder were enlarged, and there was a distended abdomen. The goat was depressed but restless and showed continuous straining (Fig. 19A, B and C). The birth canal was completely dilated, and the left ear of the fetus was visible from the outside of the vagina. A dead fetus was revealed based on the absence of reflex on pinching from the posterior vagina. On examination of the foetus's presentation, the fetus was presented in cranial-longitudinal presentation, dorso-sacral position, with left lateral deviation of the head and backward flexion of the forelimbs.

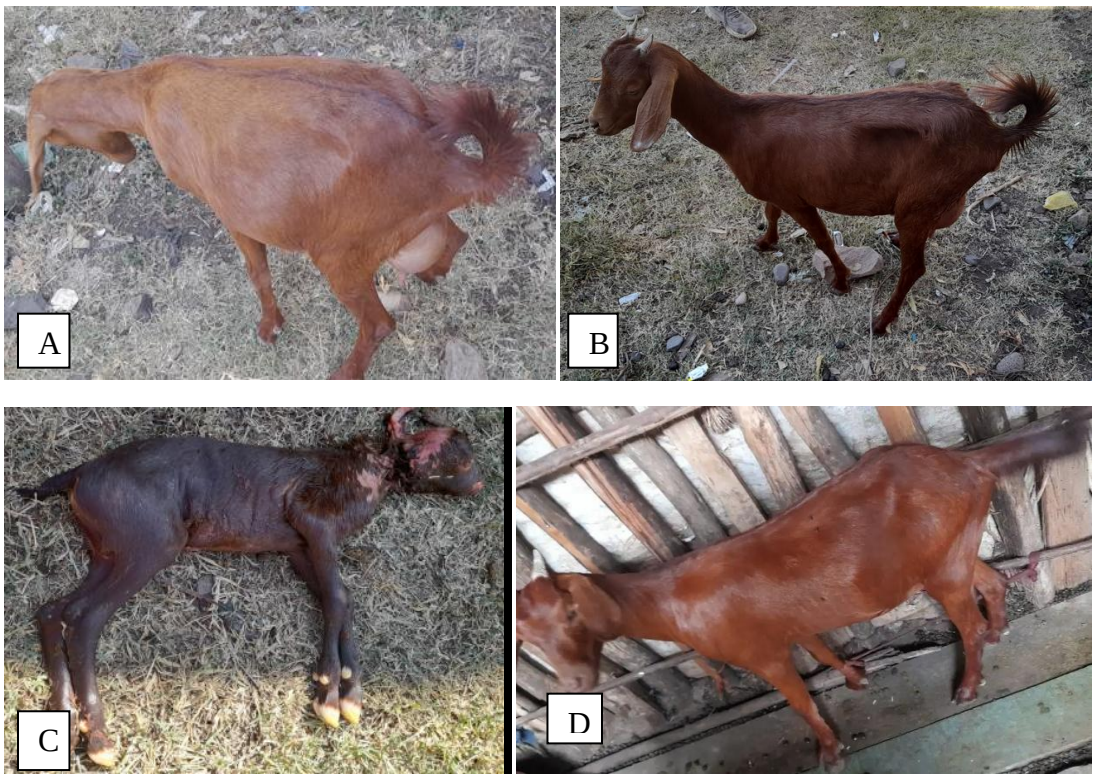

Figure 19: Showing the case of dystocia in an 18-month-old goat due to a dead fetus. Depressed goat with enlarged vulva, udder and showing straining (A), the goat soon after delivery (B), the dead fetus with broken neck (C), and the goat after three months of post treatment.

Hence, this fetus was found to have normal presentation and position but abnormal posture. Based on history and after physical and visual examination, the case was diagnosed to be dystocia due to left lateral deviation of the fetal head and backward flexion of the forelimbs.

Case management and treatment outcome

The case was managed by providing lubrication, manual correction by repulsion and traction, and broad-spectrum antibiotic therapy to prevent secondary complications and save the goat's life. Thus, the vaginal wall was lubricated with chlorhexidine. The lateral deviation of the head and neck was corrected by applying slow repulsion (the fetus was pushed back into the uterine cavity) and traction (the fetus was then pulled out) manually by wearing protective gloves until the head brought the fetus in the vaginal passage. A cut was made on the neck of the fetus, and the head was removed outward, which helped to get extra space to identify and to retract the front limbs. Then both limbs were identified and retracted. After all the extensive work, a dead male fetus was removed (Fig. 19C).

The uterus and abdomen were checked for the presence of another fetus, but it was not felt and was absent. The birth canal was disinfected using disinfectants. Long acting oxytetracycline (Chongqing Fangtong Animal Pharmaceutical Co. Ltd., China) IM injections at 20mg/kg body weight twice with the second dose after 72 hrs. Additionally, the goat was treated with Multi-Vitamin and dexamethasone sodium phosphate injections. The dead fetus was taken away from the vicinity and buried. The goat was followed for any secondary complications for a one-month period by mobile phone communication and recovered successfully with minimal complications in the vulva. The status of the goat after three months post treatment is indicated in the Figure 19D.

Discussion

Dystocia requires rapid treatment since it poses a risk to the lives of both the dam and the foetuses (Ahmed *et al*., 2019). This seriously reduces the profitability of the farmers by disturbing the availability of replacement animals and productivity.

Out of the various maldispositions, lateral deviation of the head and neck and flexion of the carpus and shoulder are the most common in sheep and goats (Purohit, 2006) as causes of fetal dystocia. Anterior presentation fetal dystocia commonly occurs in goats although posterior and dorsotransverse presentations have been recorded, (Majeed, 1994). In the present report, anterior presentation fetal dystocia due to deviation of the head with back ward flexion of the forelimbs in a goat was examined. Similar case descriptions were reported previously in sheep and goats by others (Ahmed *et al*., 2015; Ramsingh, 2021). Malik *et al. (*2019) reported fetal dystocia due to downward deviation of head with bilateral carpal flexion in goat.

In the present report, the case was managed using per-vaginal delivery by correction of the abnormal postures and forced traction of the dead fetus. A comparable handling approach was followed by Ahmed *et al*. (2015). Such a strategy, in their opinion, is recommended to reduce the farmers' medical expenses by avoiding caesarean sections. However, caesarean section was a safe method of kid delivery with a high success rate than manual correction and traction (Majeed and Taha, 1989). In conclusion, this case report indicated the clinical occurrence of dystocia due to lateral deviation of the head and flexion of the forelimbs and its successful management by manual correction and traction in goat. Therefore, in order to perform appropriate obstetrical procedures, it is crucial to make a proper diagnosis of the reasons for dystocia.

3.2.6. Concurrent gastrointestinal tract parasitosis in young sheep and goat

Abstract

Parasitic diseases are a major constraint to livestock production and development in the developing countries like in Ethiopia. This case report presents concurrent infections of the gastrointestinal parasite and its successful treatment outcome in lamb and kid kept under an extensive management system. A six-month-old lamb was presented with a history of reduced feed intake and swelling under the jaw. Physical examination revealed a rectal body temperature of 38.5 ^{O}C, a respiratory rate of 28 breaths per minute, a heart rate of 92 beats per minute. On observation, the lamb looked unthrifty and there was submandibular swelling and pale mucous membranes.

Similarly, four month old kid was presented to compliant of reduced feed intake and observation of expelled worms from the anus since the last one day. Both animals were not treated before. The rectal body temperature was 39.2 ^{O}C and the respiratory and heart rate were in the normal range. The ocular mucus membranes were slightly hyperaemic. A typical segment of tapeworm parasite belongs to *Moniezia* species were observed protruding from the anus. Both the lamb and kid were depressed and kept under extensive management system. The fecal flotation techniques result showed the eggs of *Moniezia* and strongyle species. Based on the history obtained, clinical signs, disease epidemiology, and laboratory parasitological findings, finally the cases were diagnosed as having concurrent infections of intestinal tract parasites. Both the lamb and kid were treated with oral administration of albendazole 300 mg bolus at a dose rate of 1 bolus/ 40 kg body weight. The owners were also advised about strategic deworming of other sheep and goats kept from the same grazing area. Both the lamb and kid responded to treatment and recovered well from the condition. Therefore, the presence of concurrent intestinal tract parasitic infections in the present cases is mostly associated with the epidemiological factors. This can be controlled by reducing the exposure during grazing and by the use of good management practices including accurate diagnosis and monitoring of parasitic infections.

Key words: *Albendazole, Concurrent, Haemonchosis, Kid, Lamb, Monieziasis, Strongyle*

Introduction

The gastrointestinal tracts (GIT) of animals are home to a variety of parasites, primarily helminths, which can cause both clinical and subclinical parasitism and the majority of parasitic infections are subclinical (Aktaruzzaman *et al*., 2013). It is a familiar problem in small ruminants, interfering with animal health and welfare, and causing large economic losses (Van-den Brom *et al*., 2015). The financial losses due to subclinical problems are considerably higher than clinical problems in individual animals (Aktaruzzaman *et al*., 2013). The losses are in forms of stunted growth, involuntary culling, lower weight gain, lowered fertility, treatment costs and mortality in critically parasitized animals (Oyewusi *et al*., 2017).

In addition, subclinical disease usually leads to decrease production of meat, milk and wool, secondary bacterial infections, fertility problems and great expenses with anthelmintics (Gharekhani *et al*., 2015). However, the degree of infection and co-infection of GIT parasite differ depending upon diverse extrinsic and intrinsic epidemiological and biological factors (Aktaruzzaman *et al*., 2013).

The threat of nematode parasitism is particularly significant in the poor world because small ruminant livestock frequently lacks adequate nutritional resources. As a result, natural immunity is weakened, which leads to low productivity and high mortality (Mengist *et al*., 2014). In this regard, *Ostertagia circumcincta, H. contortus, Trichostrongylus* species and *Nematodirus battus* are the most important nematode species which act as a factor which limits production of sheep (Gharekhani *et al*., 2015). Similarly, in Ethiopia, presence of many GIT nematodes, which belong to the genera *Haemonchus, Trichostrongylus, Oesophagostomum, Bunostomum, Strongyloides, Cooperia, Bunostomum, Nematodirus and Trichuris* species were investigated (Mengist *et al*., 2014).

Among the intestinal tract parasites, the blood sucking *Haemonchus contortus* is the major economically important nematode parasite of small ruminants, primarily in warm damp climates (Bassetto *et al*., 2018). It is greatly pathogenic parasite which is the main confront for sheep and goat producers in tropical and subtropical regions all over the world (Terrill *et al*., 2012; Abdo *et al*., 2017). The most specific indicative sign is anaemia, seen as pallor of the mucous membranes, in particular simply seen in the conjunctivae (Mushonga *et al*., 2018).

Monieziasis is a GIT disease brought by *Moniezia*, the wide segmented intestinal tapeworm (Zainalabidin *et al*., 2021) of ruminants with global distribution (Diop *et al*., 2015). *Moniezia expansa* and *Moniezia benedni* belongs to the most commonly occurring field helminth of sheep and goats (Sirag, 2019). The parasite is transmitted via the ingestion of pasture mite infected with larva and this parasite is regarded to be non-pathogenic but 13.95% death cases were linked the disease post-mortem reports of goats in Nepal (Ghimire and Bhattarai, 2019).

Animals like lambs and kids with heavy infestation by *M. expansa* frequently resulted in undesirable clinical symptoms such as rough coat hair, pot-belly, anaemia (Patil *et al*., 2016), stunted growth and unthriftiness (Fagbemi and Dipeolu, 1983). Additionally, in high numbers this tapeworm parasite can block the intestine (Ullah *et al*., 2013) and such obstruction usually the primary cause of death (Fagbemi and Dipeolu, 1983).

For clinical diagnosis of helminth parasites, the clinical signs, history of the animals such as age, season, grazing history and anthelmintic usage are generally sufficient (Eysker and Ploeger, 2000). Detection of the parasitic egg also important and the presence of helminth parasite in the feces can be detected either by microscopic identification of eggs or from cultured larvae (Durrani *et al*., 2007). The eggs of different helminth parasites were identified on the basis of size and morphological appearance of eggs (Kelemework *et al*., 2016).

The control of helminth is almost primarily dependent on the use of long acting anthelmintics (Balmer *et al*., 2015) either used in prophylaxis or treatment of helminth infections (Varady *et al*., 2011). This is largely because of the remarkable developments in these products in terms of efficacy, safety, spectrum of activity while remaining relatively inexpensive (Salkova *et al*., 2014). On the other hand, increasing levels of drug resistance become a major problem (Várady *et al*., 2011). Alternatively, grazing management can also be executed in the control of intestinal parasites (Miller *et al*., 1998). Therefore, this case report presents the clinical occurrence of concurrent gastrointestinal tract parasitosis and its successful management in young sheep and goat.

Case descriptions

Case 1

A six-month-old lamb was presented to the Dessie City Administration Veterinary Clinic on February 21, 2023, with a history of reduced feed intake and swelling under the jaw. The lamb was managed extensively and not treated before. Physical examination revealed a rectal body temperature of 38.5 ^{O}C, a respiratory rate of 28 breaths per minute, a heart rate of 92 beats per minute.

On observation, the lamb was depressed and looked unthrifty with submandibular swelling and pale mucous membranes of the conjunctivae (Fig. 20B and C).

Based on the history and clinical signs, the case was tentatively diagnosed as Haemonchosis, and a fecal sample was collected for the detection of parasitic eggs in the feces.

Figure 20: The clinical indication of parasitosis in the affected lamb. During physical examination (A), submandibular swelling (B), pallor of conjunctival mucous membrane (B and C), and the condition of the lamb at fifteen days of the follow up (D).

Case 2

A four-month-old kid was presented to Kombolcha City Administration Veterinary Clinic on February 16, 2023, with the main complaint of the reduced feed intake and observation of obviously expelled worms from the anus. The kid was not treated before and was kept in an extensive system with three other goats.

Based on physical examination, the rectal body temperature was 39.2 ^{O}C. The respiratory rate and heart rate were in the normal range. The ocular mucus membranes were slightly hyperaemic. A typical segment of tapeworm parasite belonging to the *Moniezia* species was observed protruding from the anus (Fig. 21B and C). The kid was depressed.

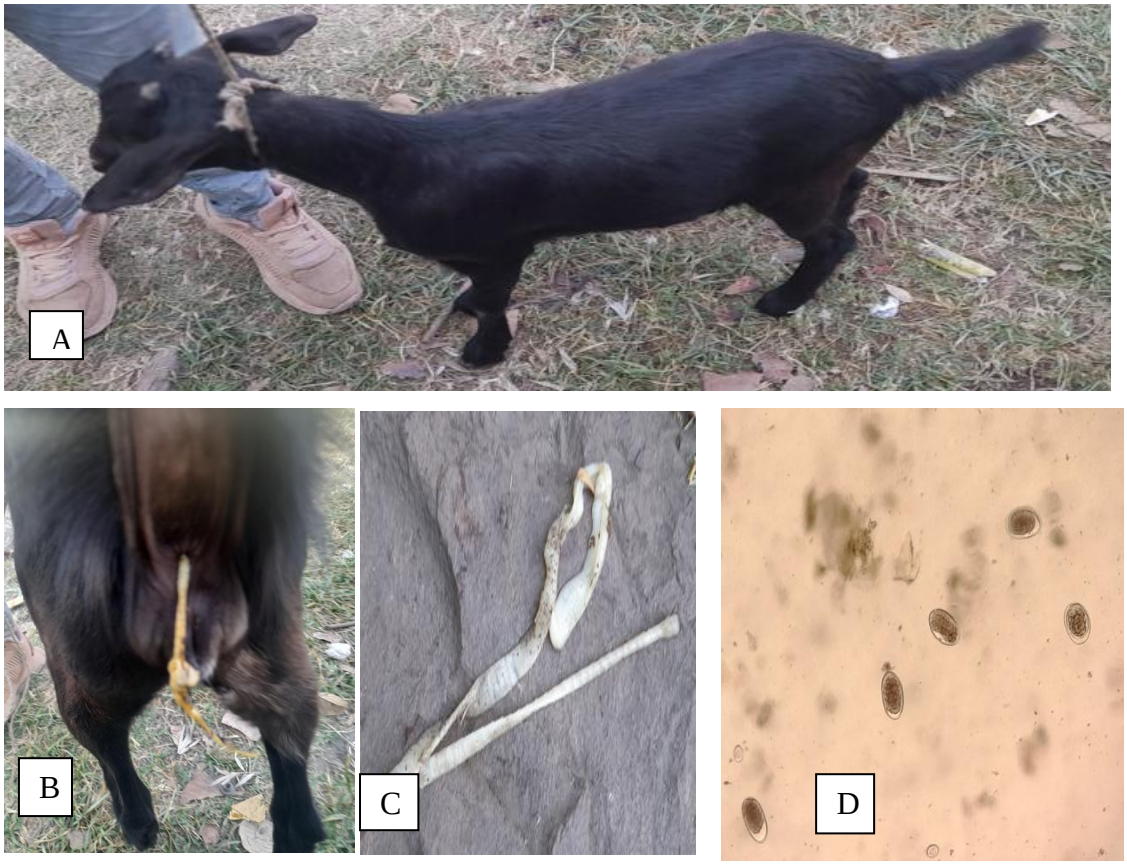

Figure 21: Indicating the affected kid. The depressed kid (A), typical segment of the *Moniezia* species protruding from the anus (B), dropped to the ground (C), and strongyle type egg at 10X microscope (D).

Laboratory investigation and findings

For confirmation of the tentative diagnosis, a fecal sample was collected directly from the rectum using a glove and immediately sent to the Kombolcha Animal Disease Survey, Investigation, and Diagnostic Laboratory. Although flotation techniques were used for the detection of roundworm infections in the fecal sample collected, a sedimentation technique (Annex 4) was also performed to detect the presence or absence of fluke eggs.

Accordingly, the fecal sedimentation test result showed no parasitic egg detected in both case one and case two. On floatation technique strongyle type eggs (Fig. 22A and B) were detected (including eggs of *Haemonchus*) in both cases. Typical triangular shaped *Moniezia* eggs (Fig. 22A and C) were observed. Therefore, the animals harboured adult strongyle worms and *Moniezia* parasites. There were up to 90 eggs of the helminth parasite per one microscopic field (case 1).

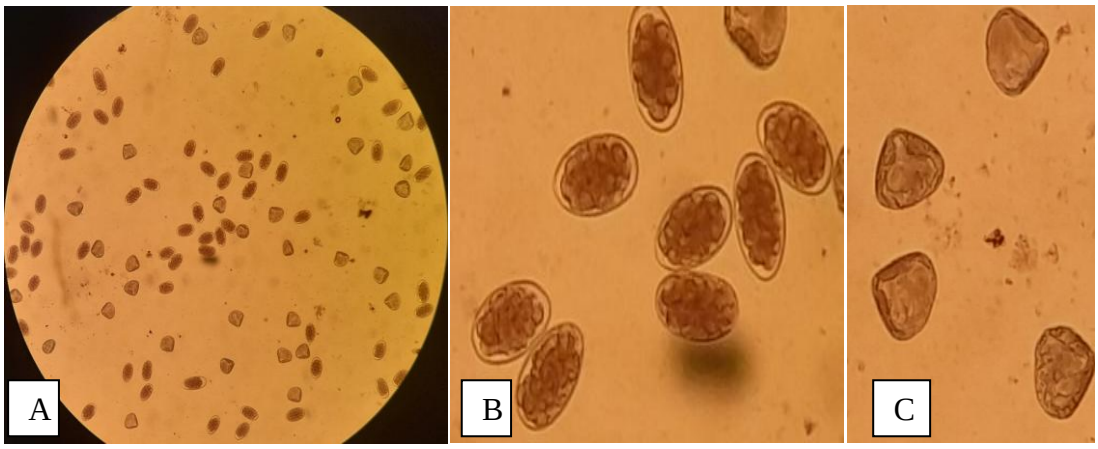

Figure 22: The eggs of helminth parasite from affected lamb at 10X microscope. Different roundworm egg and typical *Moniezia* eggs (A) close up view of different strongyle type eggs (B), and typical triangular shaped *Moniezia* eggs (C).

Based on the obtained history, clinical signs observed, disease epidemiology, and laboratory parasitological findings finally the cases were diagnosed as having concurrent infections of gastrointestinal parasite.

Case management and treatment out come

Both the lamb and kid were treated with oral administration of albendazole (300mg) bolus at a dose rate of 1 bolus/ 40 kg body weight. The owners were also advised about strategic deworming of other sheep and goats kept from the grazing area for parasitic infections in general. Based on the owner's information, both the lamb and kid responded to treatment and recovered well from the condition.

Discussion

In the present report, two separate cases of concurrent infection with intestinal helminth parasites were examined in young sheep and goat. The animals were kept under extensive management system fed on a pasture land. Thus, the report shows the occurrence of concurrent infections of economically most important endoparasites of small ruminants in field conditions. Similarly, concurrent infections of helminth parasites were familiar in goats and reported by authors Lavanya *et al*. (2017). From other study by Zainalabidin *et al*. (2021) found *M. expansa*, together with *H. contortus, Oesophagostomum columbianum,* and *Trichostrongylus colubriformis* in Malaysia in goats and they also reviewed that *Moniezia* species were more prevalent in grazing type farm management. Patil *et al*., (2016) found mixed infections of *M. expansa* and *trichuris* species from four month old kid.

In this case report, diagnosis was based on the history obtained, observed clinical sign, disease epidemiology, and microscopic examination of the fecal sample from an infected lamb and kid. Microscopic identifications of eggs using fecal floatation test revealed the presence of strongyle type eggs and typical *Moniezia* eggs. This is in consistence with the same work done by Ullah *et al*. (2013). Pale mucous membrane, weakness, and subcutaneous oedema were observed from a lamb. The adult *Moniezia* tape worm was observed in the kid. The results suggest that the clinical symptoms were coinfections induced by roundworm parasite infection and Monieziasis. In both cases the animals were young, this might be due to the fact that these animals have greater susceptibility due to lack of previous exposure to the parasite as described by Abdo *et al*. (2017). Similar to this the study by Fagbemi and Dipeolu (1983) found the highest rates of *Moniezia* infection in kids and lambs younger than eight months old.

The animals were treated by albendazole and then shows sign of improving following treatment. The use anthelmintics like albendazole for effective control of helminth parasites were reported by (Adediran and Uwalaka, 2015). Environmental factors, nutritional factors, and vector population have been implicated in the distribution of most parasitic diseases, which are most prevalent in the tropics where sanitation and nutrition standards are generally poor (Oyewusi *et al*., 2017).

Therefore, the presence of concurrent Monieziasis with strongyle roundworm infection in the present report is mostly associated with the epidemiological factors. Furthermore, the presence of risk factors like warm and humidity, poor animal management, and seasonal change leads to feed stress and other supposed to favour the distribution of concurrent diseases. This can be controlled by reducing the exposure during grazing and by using good management practices such as avoiding grazing on humid pastures and maintaining the cleanliness of the pens, water, and feeding trays. Accurate diagnosis and effective monitoring of parasitic infections were also essential.

3.2.7. Sheep and Goat pox in ewe and bucks

Abstract

Sheep pox and Goat pox (SGP) are widely prevalent diseases that affect both sheep and goats, cause a significant loss both in drop in production and productivity and death in Ethiopia. The present case report summarizes about two separate clinical cases of SGP in bucks and ewe in Harbu Veterinary Clinic, South Wollo, Ethiopia. The chief compliant of the cases were reduced feed intake, nasal discharge and nodules on the skin of different body parts. Animals in both cases were not vaccinated. On physical examination the animlas were febrile with body temperature of 40.5 to 41.2 ^{O}C. Characteristics pox lesions were revealed by visual inspection and palpation of the skin on different body parts particularly clearly seen on the tail. The skin lesions were examined at different stages, which are scabs in the bucks and papules in the ewe. Due to the absence of laboratory facility the diagnosis of the cases were based on the characteristics clinical signs and the disease epidemiology. Treatment with intramuscular injections of short acting oxytetracycline for three successive days and Multi-Vitamin, stat was arranged. One buck was revived from the condition while the other died. However, the ewe was interrupted treatment after the first administration and thus the recovery status was not known. In conclusion, the current report indicated the clinical occurrence of Sheep pox and Goat pox in ewe and bucks. Therefore, early treatment and vaccination were warranted to reduce the losses due to the disease.

Key words: *Bucks, Ewe, Goat pox, Sheep pox, Treatment*

Introduction

Sheep pox and Goat pox (SGP) are widely prevalent diseases that affect both sheep and goats, cause a significant drop in production and productivity in Ethiopia (Hurisa *et al*., 2018). Sheep pox virus (SPPV) and the goat pox virus (GTPV), both belonging to the genus Capripoxvirus, are responsible for SGP. SPPV and GPPV have different host preferences; some isolates of each virus only infect sheep and goats, respectively, whereas other isolates of SPPV and GTPV affect both species (Adedeji *et al*., 2021). The prevalence of these diseases is economically significant since it is linked to high morbidity, mortality, and export-import restrictions on sheep, goats, and their by-products (Bhanuprakash *et al*., 2010). In vulnerable herds, morbidity ranges from 75 to 100%, and case fatality ranges from 10 to 85%, depending on the virulent the virus (Fentie *et al*., 2017).

Sheep pox takes 8 to 13 days to fully develop after coming into touch with a vulnerable animal (Kitching, 2007). Both sheep pox and goat pox have similar clinical signs of fevers which peak at 40-42 ^{O}C, dyspnea and oculonasal discharge and pox lesions on unwooled skin are manifested in malignant form of Sheep pox and Goat pox (Hurisa *et al*., 2018). Multifocal cutaneous papules, pustules, and nodules are highly distinctive clinical symptoms of SGP (Adedeji *et al*., 2021). Papules are the first symptom of the lesions, which then develop into nodules, vesicles, and pustules (raised lesions), and lastly scab formations are seen on the skin (Zewdie *et al*., 2021).

In general, kids and lambs are more prone than adults (Rao and Bandyopadhyay, 200). Infections can be spread through direct or indirect contact with aerosols, respiratory droplets, or oronasal secretions from acutely infected animals (Mahmoud and Khafagi, 2016) and mechanically by flies (Rao and Bandyopadhyay, 200).

Typically, clinical symptoms are used to make the diagnosis of goat pox and sheep pox before laboratory confirmation (Rao and Bandyopadhyay, 200). Numerous laboratory techniques, including polymerase chain reaction (PCR), serology testing, and virus isolation can be employed for confirmatory diagnosis of the disease (Zewdie *et al*., 2021).

There is no effective treatment for sheep pox and goat pox infection. Management strategies should be directed to control secondary bacterial infection using parenteral administration of broad spectrum antibiotics (Senthilkumar and Thirunavukkarasu, 2010). Therefore, the present case report describes the occurrence and treatment outcomes of two separate cases of goat pox.

Case descriptions

Case 1

The owner brought his five-year-old buck to Harbu Veterinary Clinic on March 13, 2023, with the chief complaint of decreased feed intake and nodular swelling on the skin of different parts of the body. Based on the owner's information, the first signs of the disease were nasal discharge and coughing. The buck was kept semi-intensively, with other one buck having similar signs. Both bucks were not vaccinated. On physical examination, the rectal temperature was 41.2 ^{O}C, and the heart rate and respiratory rate were 78 rates per minute and 28 breaths per minute, respectively. Conjunctivitis and naso-ocular discharge were noted. Characteristics of pox lesions were revealed by visual inspection and palpation of the skin on different body parts, including the neck, shoulder, leg, and scrotum; particularly, scab lesions were clearly seen on the tail. The second buck was examined at home and had similar lesions on the skin of different body parts. The buck was febrile, with a body temperature of 40.5 ^{O}C. The respiratory rate was 20 breaths per minute, and the pulse rate was 82 beats per minute. The buck was depressed and lethargic. The clinical indications are presented in Figure 23.

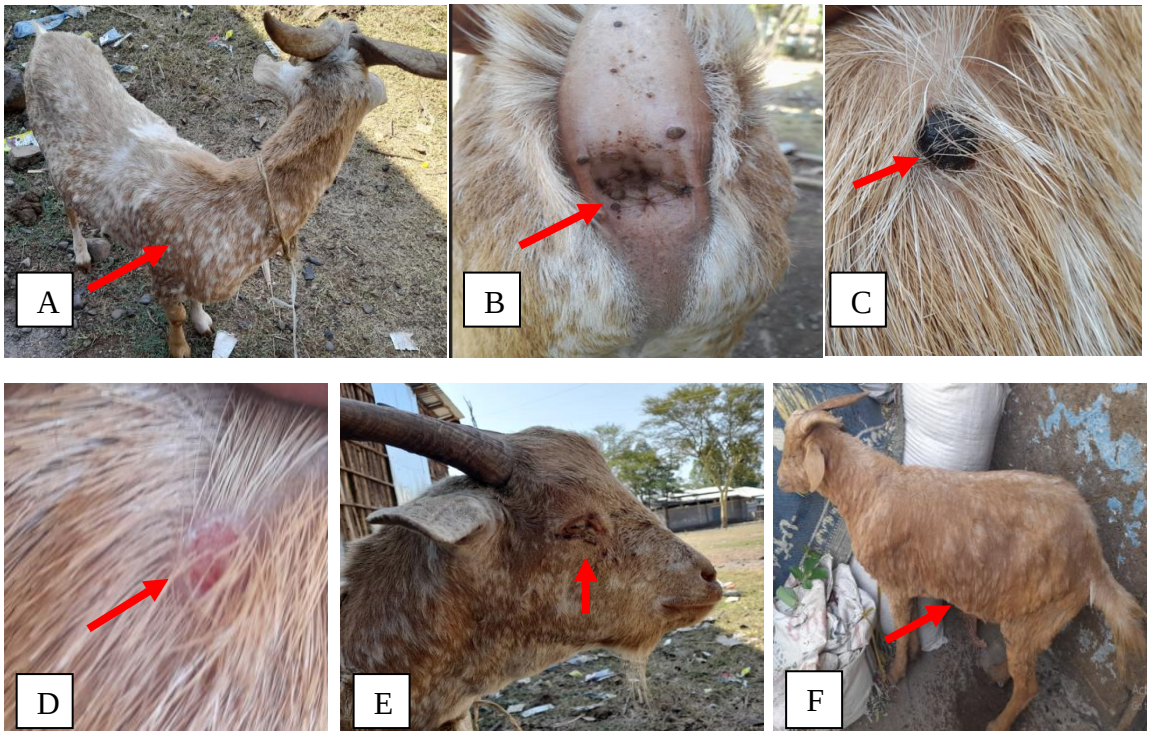

Figure 23: The buck with pox lesions. Lesions on the neck, shoulder (A), and tail and perineum (B), , dried scab from the neck region (C), lesion without skin after the scab is removed (D), conjunctivitis and ocular discharge (E), and wide spread skin eruption in the second goat (F).

Case 2

A four-year-old ewe was presented to Harbu Veterinary Clinic on March 23, 2023, with a chief complaint of reduced feed intake and the presence of skin nodules and nasal discharge for five days. The ewe was kept semi-intensively with the other three sheep. Based on the owner's information, all animals were not vaccinated before. On physical examination, the body temperature was 41 ^{O}C. The pulse and the respiratory rate were 88 beats per minute and 38 breaths per minute, respectively. The ewe was depressed and lethargic. Nodules (papules), which are hard during palpation, were seen on different parts of the body, including the tail (Fig. 24), leg, and teat. Remnants of nasal discharge were seen on the external nostrils.

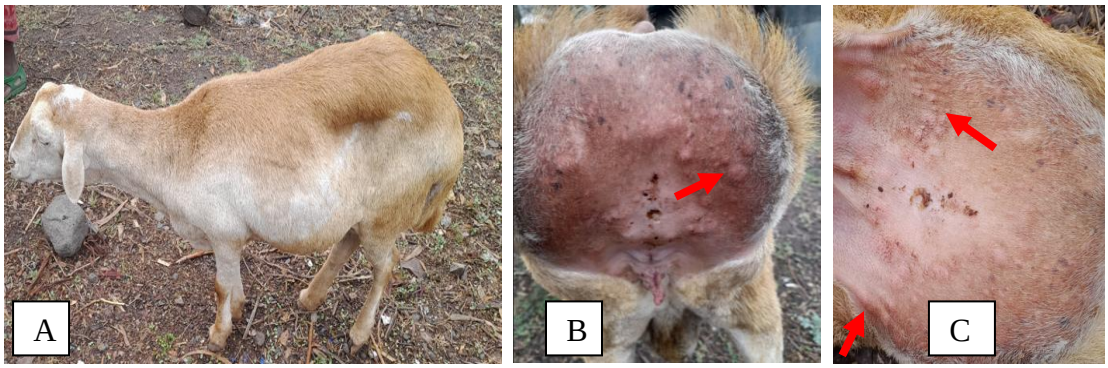

Figure 24: Clinical indications of pox lesions in the affected ewe. The depressed ewe (A), pox lesions (papules) on the tail (B).

Tissue samples from sloughed skin nodules and nasal swabs were collected for laboratory confirmation. After having collected the appropriate sample, it was properly labelled and ready to send to the laboratory with a history, including the provisional diagnosis. However, due to the absence of laboratory facilities, the laboratory confirmations of the cases were not conducted. Therefore, the final diagnosis of the cases was based on the history, characteristics of the skin lesions and the disease epidemiology as Sheep and Goat pox.

Case management and treatment out come

As the disease is viral, treatment with antibiotics is for the prevention of secondary bacterial complications. Accordingly, in both cases, oxytetracycline 10% (Shijiazhuang ZDHF Stock-Raising Co, Ltd., China) at 1 ml per 10 kg body weight was administered IM for three consecutive days. A single intramuscular injection of 4ml Multi-Vitamin (Aether Centre Biology Co, Ltd., Chaina) was also given.

Figure 25: The recovered buck.

Both owners were instructed to separate the affected animals from the healthy until full recovery. One buck revived from the condition. After a one-month visit, the buck was fully recovered from the conditions with no skin lesions (Fig. 25). However, the second buck died. The ewe was interrupted in treatment after the first administration, and thus the status of recovery was unknown.

Discussion

Sheep pox and Goat pox (SGP) are viral diseases of sheep and goats distinguished by fever, pyrexia and generalized skin lesions (Fentie *et al*., 2017) such as papules or nodules, vesicles, internal lesions, and death (Zheng *et al*., 2007). In the present case report the clinical cases of SGP were examined in bucks and ewe in Harbu Veterinary Clinic, South Wollo, Ethiopia. The disease was detected at the papule stage in the ewe and with scab formation in the bucks. Apart from nodular lesions, loss of appetite, weakness, fever, eye lesions with ocular discharge, nasal discharge were recognized from the affected animals in the present cases. This signs of SGP were in agreement with the signs described by (Zheng *et al*. (2007) and Zewdie *et al*. (2021). Clinically, SGP typically recognized by the appearance of nodular skin lesions, primarily in the mouth and perineum areas (Gelaye and Lamien, 2019). In the same way in the present instances, nodular skin lesions were observed on the tail and around the perineum.

SGP are widely prevalent throughout Ethiopia and contribute significantly to both death and productivity losses (Zewdie *et al*., 2021). Similarly, death of one buck was noticed in the present instances. The death might be resulted from the lesions in the respiratory system that may affect the normal air flow. In conclusion, the current report indicates the clinical occurrence of SGP in bucks and ewe. Therefore, early treatment and vaccination were warranted to reduce the losses due to the disease.

3.2.8. Fasciolosis in ewes and ox

Abstract

Fasciolosis is among the major disease problems of farm animals, which imposes direct and indirect economic impact on livestock production, particularly of sheep and cattle.

In these case studies a clinical case of Fasciolosis were examined and handled in ox and sheep. The sheep was presented with history of reduced feed intake and swelling under the jaw in one of the ewes since five days before. Physical examinations revealed that one of the ewes was depressed, had minor swelling under the mandible, pale mucous membranes and a capillary refill time of around 6 seconds. On the other hand, the ox showed sub mandibular swelling and had good body condition and normal mucous membranes. In both animals the body temperature, respiratory rate and heart rate were in the normal range. Both were kept extensively and fed by grazing on natural pasture land which is water logged. The microscopic fecal examination showed the presence of the eggs of *Fasciola* in both cases and additional round worm egg in the ewe. Based on the information on the history of the grazing area, disease epidemiology, observed clinical findings, and laboratory fecal sample examination results, the final diagnosis of the cases were ovine Fasciolosis along with roundworm infection in the ewe and bovine Fasciolosis in the ox. All the sheep were treated with single oral administration of triclabendazole bolus, 250 mg at a dose rate of 10 mg/ kg body weight in combination with 1% ivermectine. On the other hand, the ox was treated with oral administration of YZ-Tetoxy 900 mg bolus (combinations of tetramisole hydrochloride and oxyclozanide) at a dose of 2 boluses per 75 kg body weight. The owners were also advised about strategic deworming for parasitic infection in general and the application of fluckicide and the provision of worm-safe pasture, which restricts animals from grazing on marshy areas, for the successful prevention and control of fluke infection in particular. Based on the owner's information, in both cases, the animals responded to treatment and recovered well from the condition. In conclusion, it can be said that early intervention for Fasciolosis, through the use of appropriate dosages and regimens, can lead to positive outcomes.

Key words: *Ewe, Fasciolla, Fasciolosis, Ox, Triclabendazole*

Introduction

Fasciolosis is one of the many parasite problems that affect farm animals with a significant impact on livestock output, especially that of sheep and cattle (Swai and

Ulicky, 2009). It affects a variety of animal species all over the world and is caused by the liver flukes of the genus *Fasciola*, specifically *F. hepatica* and *F. gigantica (*Stuen and Ersdal, 2022*). Fasciola hepatica* is a pathogenic trematode parasite with a global distribution (Charlier et al., 2014) while *F. gigantica* is found on most continents primarily in tropical region (Akinaw, 2021). The disease is neglected tropical disease and found in many countries especially where sheep and cattle are reared (Mehmood *et al*., 2017) which bring about pathological problems and economic losses in agribusiness (Dorny *et al*., 2011). The impact can be wide-ranging like reducing productivity through lower meat and milk yields, increasing liver condemnation, causing greater susceptibility to other infections, and as a cause of mortality (Beesley *et al*., 2023).

The incidence in farm animals increased after a period of high rainfall (Mehmood *et al*., 2017).Thus, the occurrence was highest during the period immediately before and after the commencing of short rain (Swai and Ulicky, 2009). This is because, as snails reproduce during the wet season and is reduced when snail populations fall during the dry season and the metacercariae on pasture don't survive into the dry season (Roberts, 1996). On the other hand, ruminants mainly become infected by ingestion of metacercariae, (the infectious stage) during the dry season, when they graze in previously flooded areas (Khan *et al*., 2013). In general, the variation in climato-ecological conditions including temperature, altitude, rainfall, livestock management system, and suitability of the environment for distribution and survival of the parasite and availability of suitable snail environment are most important factors that manipulate the rate of Fasciolosis in a particular area (Bekele *et al*., 2010).

The life cycle of these trematodes involves snail as an intermediate host (Walker *et al*, 2008). Thus, liver fluke transmission is dependent on the presence of its snail intermediate host; therefore, the distribution of the parasite is restricted to geographic areas where the suitable snail species is present (Kaplan, 2001). Wet seasons combined with humidity brought on by a wet-warm climate are also suggested as likely causes because they encourage the growth and development of Fasciola species and its intermediate hosts, snails (Suhardono and Copeman, 2000).

Hence, the epidemiology of the disease is closely associated with ecological factors (Garg *et al*., 2009) the disease is found in vast water lodged and marshy grazing field condition anticipated to be ideal for the propagation and maintenance of high prevalence of Fasciolosis (Seid and Melese, 2018).

Acute Fascioliasis causes a substantial economic loss, which includes death, loss of carcass weight, reduction in milk yield, condemnation of affected livers; decline reproductive performance, predisposition to other diseases and cost of treatment (Swai and Ulicky, 2009). Clinical disease resulting from chronic infection is uncommon in cattle; it is most frequently seen in cattle younger than 2 years and is characterized by weight loss, anaemia, hypoproteinaemia, general depression, and occasionally death (Kaplan, 2001). In sheep, clinically it is manifested by dullness, weakness, lack of appetite, pallor of mucosa and conjunctiva and pain when pressure is exerted over the area of the liver (Spithill and Dalton, 1998). Signs may include oedema or swelling under the jaw (bottle jaw) (Charlier *et al*., 2014).

Accurate diagnosis of Fasciolosis is always remained a challenging task for the field practitioners (Mehmood *et al*., 2017). The clinical sign, grazing history and seasonal occurrence, examination of feces by laboratory tests and post mortem examination are important in the diagnosis of Fasciolosis (Admassu *et al*., 2015b). The classical method for the diagnosis of Fasciolosis is the detection of eggs in feces, mostly based on sedimentation of eggs, using low magnification conventional microscopy (Charlier *et al*., 2014).

Treatment with flukicides is frequently used as the only option to control Fasciolosis *(*Stuen and Ersdal, 2022). Treatment with the anthelmintics triclabendazole as the drug of choice is recommend in the control of Fasciolosis (Beesley *et al*., 2023) as this effectively kills the liver flukes and their eggs. However, in cattle, drugs like rafoxanide and nitroxynil other than triclabendazole are more effective (Seid and Melese, 2018). On the other hand, the emergence of triclabendazole-resistant parasites poses a major health concern and complicates the *Fasciola* control programs (Khademvatan *et al*., 2019).

Moreover, other control methods include environmental sanitation and manipulation (draining, swamps, building sewage system and providing clean water supplies), and rotational grazing were helpful (Abdisa and Jilo, 2017). Therefore, the present case report presents about the detection of clinical causes of Fasciolosis in ewes and ox.

Case descriptions

Case 1

On February 21, 2023, two five-year-old local breed ewes with two lambs were examined at the Dessie City Administration Veterinary Clinic. One of the ewes had a history of reduced feed intake and swelling under the jaw since five days before. The ewes were kept extensively and fed by grazing on natural pasture land, which is waterlogged. All the animals had never been treated before. The physical examination of one of the ewes (diseased) revealed a body temperature of 38.6 ^{O}C, a respiratory rate of 16 breaths per minute, a heart rate of 80 rates per minute and a capillary refill time of around 6 seconds. On observation, the ewe was depressed had minor swelling under the mandible, pale mucous membranes (Fig. 26B and C). The clinical parameters of the lambs and the other ewe were normal but looked depressed.

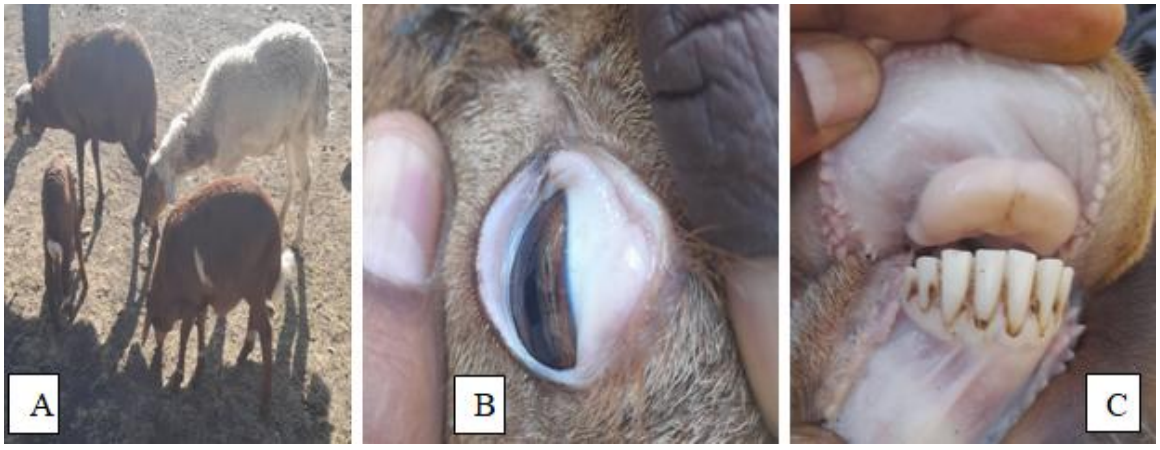

Figure 26: Evidence of clinical presentations of the ewe affected by Fasciolosis. Depression (A) and whitish appearance of mucosa the conjunctiva (B) and the gum (C).

Case 2

A local breed ox was examined at Harbu Veterinary Clinic on March 3, 2023, with a history of swelling under the jaw since eight days before. The ox was purchased from an area of marshy land and managed extensively. Physical examination revealed a rectal body temperature of 38.3 ^{O}C, a respiratory rate of 20 breaths per minute, and a heart rate of 74 rates per minute. Upon gentle pinching of the skin, it returns immediately to its position, and capillary refill time was around two seconds. There was submandibular swelling, and a serious watery fluid was removed on aspiration using a syringe and needle. The ox had good body condition and normal mucous membranes (Fig. 27). Based on information on the history of the grazing area, disease epidemiology, and clinical findings, a tentative diagnosis was established as both cases could be Fasciolosis. Fecal samples from the diseased ewe (case 1) and ox (case 2) were collected for the detection of parasitic eggs.

Figure 27: An ox with submandibular swelling along with the briscket due to Fasciolosis.

Laboratory investigation and findings

For confirmation of the tentative diagnosis, fecal samples were collected directly from the rectum using a glove and immediately sent to the Kombolcha Animal Disease Survey, Investigation, and Diagnostic Laboratory. Although, the sedimentation technique is used to detect the presence or absence of fluke eggs in the fecal sample collected, flotation techniques (Annex 4) were also performed for other roundworm infections.

The fecal flotation examination result showed no parasitic egg detected from the fecal sample test in case 2, whereas a roundworm egg (Fig. 28C) was observed from animals described in case 1. Up on the sedimentation technique, golden-coloured oval opreculated eggs (eggs of *Fasciola*) were observed in both cases (Fig. 28 A and B). Therefore, the animals harboured adult *Fasciola* parasites.

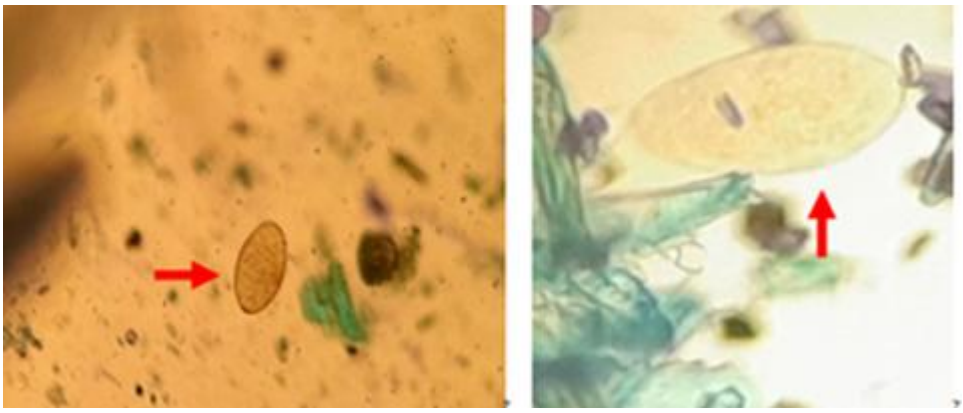

Figure 28: The egg of *Fasciola* from the ewe and ox (left to right).

Based on the tentative diagnosis and laboratory fecal examination results, the final confirmatory diagnosis of the cases was ovine Fasciolosis along with roundworm infection in case one and bovine Fasciolosis in case two.

Case management and treatment out come

Although, only one ewe has the disease condition due to the animals sharing the same grazing area, treatment of all animals is necessary (case 1). Thus, the sheep were treated with single oral administration of triclabendazole bolus (FSHINASH ®SHEEP), 250 mg at a dose rate of 10 mg/ kg body weight in combination with 1% ivermectine (Herbei Hobe Harmony Pharmaceutical Co. Ltd., China) at a dose rate of 1 ml/50kg body weight, SC, State to treat other roundworm infections. On the other hand, the ox was treated with oral administration of YZ-Tetoxy 900 mg bolus (combinations of tetramisole hydrochloride and oxyclozanide) at a dose of 2 bolus/ 75 kg body weight. The owners were also advised about strategic deworming for parasitic infection in general and the application of fluckicide and restricts animals from grazing on marshy areas, for the successful prevention and control of fluke infection in particular.

Based on the owner's information by mobile phone calling, in both cases, the animals responded to treatment and recovered well from the condition.

Discussion

Fasciolosis is a serious disease that affects livestock production, particularly that of sheep and cattle, and is one of several parasite issues that affect farm animals (Bekele *et al*., 2010). It causes large-scale mortality among young stock, leading to extreme economic losses to the livestock industry (Yuan *et al*., 2016). The occurrence of Fasciolosis is influenced by changes in the climate-ecological conditions, livestock management practices, and the survival and dissemination of the parasites as well as their intermediate host (Seid and Melese, 2018). In this case study a clinical case of Fashiolosis were examined and managed in an ox and ewes, both were kept extensively and fed by grazing on marshy area. Both species manifest different clinical features. The ewe was depressed, had swelling under the mandible, and pale mucous membranes while the ox manifested submandibular swelling and had normal mucous membranes. In both animals the body temperature, respiratory rate and heart rata were in the normal range. This difference in clinical appearance of Fasciolosis in the two animals examined might be due to variation in the number and stage of flukes present in the liver or due to the forms of the disease in the animals as described by Stuen and Ersdal, (2022*)* and Akinaw, (2021), respectively.

Diagnosis of Fasciolosis is based on clinical sign, grazing history and seasonal occurrence, examination of feces by laboratory tests and post mortem examination (Admassu *et al*., 2015b; Seid and Melese, 2018). The classical method for the diagnosis of Fasciolosis is the microscopic detection of eggs in feces, by sedimentation techniques (Charlier *et al*., 2014). Thus, the presence of the egg from fecal examination indicates as the animals harboured adult Fasciola parasites. Similarly, in the current report, the final diagnosis was mad by observed clinical sign, the obtained history of grazing on marshy area and the laboratory detection of Fasciola egg from fecal sample by sedimentation techniques. According to Abdisa and Jilo (2017) detection of the oval percolated egg in the feces by sedimentation techniques is confirmatory diagnosis for Fasciolosis and as *Fasciola* eggs have high specific gravity, sedimentation is preferred to floatation.

In the present case study was managed by using single dose of triclabendazole bolus for the treatment of Fasciolosis due to immature and adult stages of *Fasciola* in the ewe along with subcutaneous injection of ivermectine for treat other roundworm infections. Tetoxy (combinations of tetramisole hydrochloride and oxyclozanide) was used to treat the ox. The treatment arrangement was in agreement with the description documented by Seid and Melese (2018). As the prognoses in both cases were good, both animals were responded to treatment and recovered well. Furthermore, the owners were advised up on the application of fluckicide and provision of worm safe pasture for successful prevention and control of fluke infection. In conclusion, it can be said that early intervention for Fasciolosis, through the use of appropriate dosages and regimens, can lead to positive outcomes.

3.2.9. Frothy bloat in a ram

Abstract

Frothy bloat is the most common non-infectious disease in ruminant animals as a result of poor feeding management. In the present case study, a ram with frothy bloat due to sudden access to lush legume feed was examined in the Kombolcha City Administration Veterinary Clinic. The ram was presented with a history of reduced feed intake, abdominal distension, and frequent defecation of soft feces. The ram was managed intensively for fattening purposes. The feeding history revealed that the ram consumed vegetable residues like cabbage leaves and salad from the market area one day before. Physical examination revealed a rectal body temperature of 38.0 ^{O}C, a respiratory rate of 16 breaths per minute, a heart rate of 72 rates per minute, and decreased rumen motility. On observation, the ram was depressed and lethargic, had a distended abdomen mainly from the left side, and the perineum was soiled with faces. The conjunctival mucus membrane was congested. There was evidence of pain on palpation of the abdominal area. Based on the feeding history obtained from the owner and the observed clinical findings, along with the immediate treatment response, the case was confirmed as frothy bloat due to sudden feed change to legume vegetable forage. Furthermore, the examination of the feces on the third day of the follow-up revealed the presence of

strongyle-type eggs. The ram was treated using oral administration of 100 ml of cooking oil, with forced exercise. In addition, 1% ivermectine was given to deworm the ram. The ram responded well to treatment, and weight gain was observed during the follow-up period. In conclusion, frothy bloat due to sudden changes in feed is a problem of concern in sheep production. Therefore, it is very important to avoid sudden and drastic ration changes for these animals.

Key words: *Bloat, Frothy, Oil, Ram*

Introduction

Bloat is a condition that has been documented in agricultural literature for many years (Saber, 2016). It is an over distension of the rumeno-reticulum with fermentation gases, either as a persistent foam mixed with the ruminal contents, known as primary or foamy bloat, or as free gas isolated from the ingesta, known as secondary or free-gas bloat (Ibrahim, 2019). Based on grazing behaviour, sheep should bloat more severely than cattle since they prefer to consume leaves over stems and chew what they eat more frequently than cattle (Colvin *et al*., 1988). Furthermore, sheep appear to prefer legumes over grasses because legumes can be consumed more quickly (Saber, 2016). To get rid of the gas, the animals belch around once every minute. When something interferes with this gas escape, or if fermentation is excessively quick, gas becomes trapped in the rumen, resulting in bloat (Gawai *et al*., 2019).

Bloat happens when the eructation process is hindered or blocked and the rate of gas generation outpaces the animal's ability to expel the gas (Majak *et al*., 2003). Bloat in ruminants on pasture has increased due to the introduction of highly digestible legumes into cultivated wet pastures or grains (Yami and Zewdie, 2009). It is associated to feeding diets that contain large quantities of cereal grain in ruminants in confinement or kept by the home and provided solely feed such as dry bread (Yami and Zewdie, 2009; Wang *et al*., 2012). Small particles in the finely ground grain are responsible for both foam formation and stabilization in the rumen (Moeller *et al*., 2012).

In ruminants, there are two types of bloat: free-gas bloat and frothy bloat (Majak *et al*., 2003). Free-gas bloat is induced by trapping of gas produced by fermentation of readily digestible foods, whereas frothy bloat is caused by entrapment of gas caused by fermentation of highly digestible feeds (Wang *et al*., 2012). Frothy bloat can be caused about by overeating lush, damp feeds such as wet, green pasture with a high proportion of legumes causes excessive gas bubbles in the rumen. Foam occurs in the rumen with tiny gas bubbles, making it impossible for an animal to belch and expel gas (Yami and Zewdie, 2009). The interplay of plant, animal, and microbial components results in foam generation (Clarke and Reid, 1974). Thus, soluble protein levels in feed, feed digestion rates, bacterial slime production, and digesta passage rates all influence the likelihood of bloat (Majak *et al*., 2003; Wang *et al*., 2012).

Sheep with foamy bloat showed an inflated abdomen, discomfort, significant distress, kicking at the belly, difficulty in breathing, recumbency, and rapid death (Mlimbe *et al*., 2020). In terms of physiological measures, foamy bloat raises respiration rates and pulse, lowers rectal temperature and rumen motility, and congested conjunctival mucous membrane. In severe cases, cyanosis of the mucosal membrane, bulging of the eyes, and death owing to respiratory failure may occur (Ibrahim, 2019). Projectile diarrhea happens on occasion, and the animal may discharge soft feces (Tagesu, 2018).

The precise identification of bloat causes is made in the hope that a dependable course of action can be performed to eliminate it (Ibrahim, 2019). The clinical diagnosis of foamy bloat is obvious, and based on the clinical signs and history of access to lush pasture. A stomach tube can tell the difference between free gas and frothy bloat. If the bloat is free gas, a stomach tube inserted into the rumen will allow the gas to leave. There is no such gas in foamy bloat (Tagesu, 2018).

The treatment strategy is determined by the circumstances in which bloat occur, whether the bloat is frothy or free gas, and whether or not the bloat is life threatening. In the case of foamy bloat, for example, an antifoaming agent should be supplied through the stomach tube (Tagesu, 2018). The most successful strategy to treat and prevent foamy bloat is by administering antifoaming agents with a number of other sources, such as oil, fat, non-ionic surfactant, and ionophore antibiotic (Rahman *et al*., 2016).

Traditional treatments for curing bloat in animals include holding the animal in a standing position, exerting lifting pressure on the side of the stomach, and helping the animal salivate by tying a smooth stick crosswise in the mouth (Yami and Zewdie, 2009). Oil administration through stomach tube has long been advocated as a treatment for bloat in cattle, and the anti-bloat actions of particular oils may be connected to their fatty acid makeup (Wang *et al*., 2012).

Case description

The owner brought his one-year-old ram to Kombolcha City Administration Veterinary Clinic on the early morning of January 13, 2023, with a history of reduced feed intake, abdominal distension, and defecation of soft feces. The ram was managed intensively for fattening purpose. The feeding history revealed that the ram consumed vegetable residues like cabbage leaves and salad from the market area for the first time one day before. Physical examination revealed a rectal body temperature of 38.0 ^{O}C, a respiratory rate of 16 breaths per minute, a heart rate of 72 beats per minute, and decreased rumen motility (1 cycle per minute). On observation, the ram was depressed and lethargic, had a distended abdomen mainly from the left side, and the perineum was soiled with feces. The conjunctival mucus membrane was congested. There was evidence of pain on palpation of the abdominal area. The condition of the ram at day one is indicated in Figure 29 A, and B. Based on the feeding history obtained from the owner and the observed clinical findings, the presumptive diagnosis of the case was bloat due to sudden access to lush legume feed.

Furthermore, a fecal sample was examined for detection of the presence of an internal parasite on the third day of the follow-up. The sample was collected directly from the rectum using two fingers and immediately sent to the parasitological laboratory of the Kombolcha Animal Disease Survey, Investigation, and Diagnostic Laboratory for fecal examination. Both fecal flotation and sedimentation tests were performed (Annex 4). The fecal flotation examination result showed different thin-shelled and elongated parasitic eggs, which are the eggs of the strongyle species (Fig. 30). Therefore, the ram harboured an adult strongyle parasite. There were no parasitic eggs detected in the fecal sedimentation technique.

Figure 29: Indicating the affected ram before and after treatment. Depressed ram with distended abdomen (A), congested conjunctival mucus membrane (B), the ram at the third day (C), and after two months of post-treatment (D).

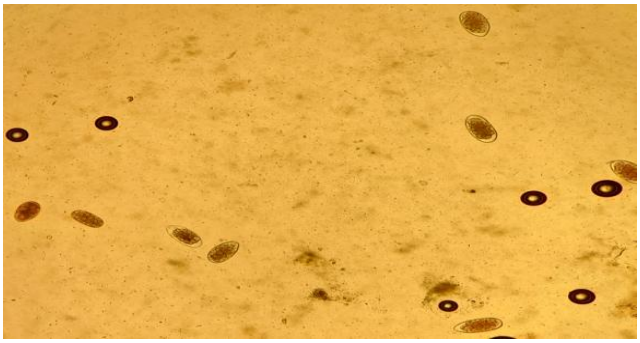

Figure 30: Different egg of strongyle species detected from the ram.

Case management and treatment out come

The treatment of the case was based on the recommendation of DACA (2006). The ram was treated with 100 ml of cooking oil per mouth, stat, coupled with forced exercise to alleviate abdominal distension. At the third day of the follow-up, 1% ivermectine (Herbei Hobe Harmony Pharmaceutical Co. Ltd., China) at a dose of 1 ml/50kg body weight, SC, state, was given for the treatment of parasitic infection. The owner was informed to restrict the ram from easily digested feed and to avoid sudden and drastic ration changes by keeping water and salt available at all times to the animals. The ram responded well to treatment, and the distended abdomen starts to reduce immediately in the late afternoon of the same day of treatment. Diarrhea was removed after the next day of treatment. At the third day of visit the distended abdomen completely reduced (Fig. 29C).

Finally, based on the feeding history obtained from the owner and the observed clinical findings along with the immediate treatment response, the case was diagnosed as frothy bloat due to sudden access to copious legume feed.

Following a two-month follow-up, the health of the ram has markedly improved, and an increase in weight has been noted, as shown in Figure 29D. Unfortunately, the owner contacted me three months after the treatment and informed as the ram died due to the consumption of a large amount of "enjera".

Discussion

Frothy bloat is the most common non-infectious disease of ruminant animals as a result of poor feeding management and access to high protein-rich leguminous plants and forage (Tagesu, 2018). In the present case study, a ram with frothy bloat due to sudden access to lush legume feed was examined in Kombolcha City Administration Veterinary Clinic. Animals eating lush legume pastures develop frothy bloat, and it is believed that legumes have more protein and are more digestible, resulting in increased formation of frothy bloat (Sears and Rood, 2019). In the present case, the final diagnosis was based on a feeding history obtained from the owner and observed clinical findings, along with an immediate treatment response.

Distress, discomfort, abdominal distension, congested conjunctival mucous membrane, reduced rumen motility, and diarrhea were noted in the present case study. These observations were in agreement with the signs described by other authors (Ibrahim, 2019; Mlimbe *et al*., 2020).

Frothy bloat is more unsafe than free gas bloat (Gawai *et al*., 2019) and a potentially fatal illness if left untreated (Yami and Zewdie, 2009). The use of antifoam chemicals to break down the foam in the rumen is a direct and effective technique for inhibiting frothy bloat (Wang *et al*., 2023). Oral administration of alkalinizing agents is generally recommended. However, due to the unavailability of such agents at the time of diagnosing this case, the management strategy of the case was to alleviate the abdominal distension by stopping the formation of additional gas and the elimination of the gases previously present. As a result, the ram was treated using oral administration of oil, which is similarly described by Wang *et al*. (2012) and Rahman *et al*. (2016). Furthermore, in the present case 1% ivermectine was given for the treatment of strongyle type parasitic infection. This is in agreement with the report by Sultana *et al*. (2022). The ram responded well to treatment, and weight gain was observed during the follow-up period.

In conclusion, as indicated by this case report, frothy bloat due to sudden changes in large amount of legume feed is a problem of concern in sheep production. Therefore, it is very important to avoid sudden and drastic ration changes for these animals.

3.2.10. Lameness associated with interdigital pouch in ewe

Abstract

Inflammation of the interdigital pouch produced moderate to severe lameness. Lameness associated with interdigital pouch was examined in the ewe at the Dessie City Administration Veterinary Clinic, South Wollo, Ethiopia, on February 23, 2023. The major complaints were lameness after ticks removed from the digits and reduced body weight. The ewe was managed under an extensive system with other sheep and goats. On physical examination, the rectal body temperature was 39.4 ^{O}C, and the respiratory and heart rates were 17 breaths per minute and 85 beats per minute, respectively.

The status of dehydration and colour of the visible mucous membrane were in a normal state. The clinical examination of the ewe revealed lameness and painful swelling from the right forelimb, anteriorly at the dorsal aspects of the interdigital cleft. At the area, there was an opening with a sticky discharge pathway to the outside. Based on history, clinical examination, and findings, the case was diagnosed as lameness associated with interdigital pouch, and its management using surgical excision was performed. Finally, the long, narrow, pipe-like structure with a wide blind sac was removed. The pouch was dissected out lengthwise, and physical examination revealed brown-like debris and white tufts of hair distributed across the pouch's interior lining. The skin was closed using interrupted horizontal mattress sutures. The wound area was cleaned with 1% iodine. Oxytetracycline injection once a day for three days was given to prevent secondary bacterial complications. After five days of follow-up, the ewe was able to use the limb, and complete recovery was observed after ten days of post-treatment without any unwanted troubles and the ewe had normal movement. In conclusion, this case report indicated the clinical occurrence and useful management of interdigital pouch lameness in sheep, but there are still gaps in the knowledge base that need to be filled. Therefore, conducting further study and train field practitioners on routine care and management of the case is also important to reach a popular standard of skill.

Key words: *Interdigital Pouch, Lameness, Sheep, Surgical Excision*

Introduction

Lameness is a common source of welfare and economic problems in many nations, and it results in significant economic losses for both the individual and the herd by limiting the availability of meat, milk, and offspring (Yurdakul and Yildirim, 2018). Lameness in Artiodactyls, particularly sheep, is high on the list of breeding concerns (Avdic *et al*., 2013). The factors that predispose sheep to lameness include harsh environmental topography, chronic wetness of the house floor, unsanitary ground conditions, dirty and overgrown hooves, fractures and traumatic injuries, systemic and local microbiological factors, and inflammation of the anatomical structures and glands (Bokko *et al*., 2003).

Most commonly, foot rot, trauma, interdigital dermatitis, toe abscesses, severe claw deformations, and contagious ovine digital dermatitis are implicated (Oliveira *et al.*, 2019). All of them come with disorder in the interdigital space (Awaad *et al*., 2015). Systemic disease such as Foot and mouth disease and Bluetongue can also induce lameness in sheep (Oliveira *et al*., 2019).

Inflammation of the interdigital pouch induce moderate to severe lameness (Shittu, 1987). It is a clinically important condition, and its infection induces 15.9% of lameness in sheep (Bokko *et al*., 2003). The interdigital pouch is also called the biflex canal (Misk and Misk, 2013), a growing organ (Sivachelven *et al*., 1992), the interdigital gland (Yilmaz *et al*., 2017; Oliveira *et al.*, 2019; Dharani *et al*., 2021; Rajagopal *et al*., 2022), and the interdigital sinus (Aslan *et al*., 2010; Awaad *et al*., 2015). It is a distinctive tubular integument invagination that opens at the dorsal aspect of the interdigital cleft. In sagittal section, it is similar to a pipe with a thin, long neck and a blind sac (Misk and Misk, 2013). Histologically, it is a thin-skinned glandular pouch with primary hair follicles and lobulated sebaceous and a porcine glands on its wall (Sivachelvan *et al*., 1992). From the inside out, the gland's wall was made up of the epidermis, dermis, and capsule (Dharani *et al*., 2021).

The specific function of interdigital pouch is yet unknown (Misk *et al*., 2013). However, other authors describe it as a skin invagination that secretes pheromones that serve important biological functions in nonspecific chemical communication roles such as sexual communication, territorial demarcation, and social behaviour expression (Abdi *et al*., 2020). On the other hand, the gland contains fungicidal and bactericidal properties as well as UV radiation protection (Awaad *et al*., 2015). In even-toed ungulates, the interdigital pouch located between the digits serves as a scent gland (Rajagopal *et al*., 2022). It is found in both the fore forefoot and hind foot, and it excretes an oily fluid of varying viscosity and composition through a noticeable opening at the anterior portion of the interdigital cleft (Aslan *et al*., 2010). Its clinical significance is enhanced by its location and structure. Because of its location, the gland is vulnerable to infections such as interdigital sinusitis, which can be caused by poor hygiene and high humidity levels, as well as mechanical damage from foreign bodies (Yilmaz *et al*., 2017).

In addition, because it is located on the antero-superior portion of the interdigital cleft, it may push on the surrounding digital nerves and blood vessels, causing pain and lameness in the affected limbs (Shittu, 1987), especially in a hard, abrasive environment (Sivachelvan *et al*., 1992). Interdigital pouch infection disturbs the oxidant-antioxidant equilibrium, which develops oxidative stress in favour of oxidants (Yurdakul and Yildirim, 2018). Moreover, the small opening of the interdigital sinus may serve as a point of entry for Fusobacterium necrophorum, which causes foot rot in sheep (Awaad *et al*., 2015). In sheep, the clinical implications of interdigital pouch lameness were studied by Egwu *et al*. (1994) and bacteriologically, *Staphylococcus aureus* and *Corynebacteriu m* species were the dominant isolates of the affected cases.

Surgical excision of the damaged pouch appears to be the most effective treatment, with the sheep able to use their limbs 1-3 days after treatment (Egwu *et al*., 1994; Bokko *et al*., 2003). In young lambs, the pouch should be surgically excised to prevent infection and lameness (Oliveira *et al*., 2019).

The clinical relationship or correlation of the interdigital pouch with the Foot root and Tungiasis as cases of lameness was not clearly reported. As a result, many field workers may misdiagnose the ailment and treat it incorrectly. Additionally, in Ethiopia, its clinical prevalence and management, as well as the microbiological and pathological implication in the affected species of animals, have not been described previously. These all indicates the presence of knowledge gaps that need to be filled. Undoubtfully, presentation of case information and documentation of such an under recognized but clinically significant illness are critical in drawing attention to further research on its implications and associated risk factors. As a result, this case report describes the clinical diagnosis of interdigital pouch lameness and its management using surgical excision in sheep.

Case description

A six-year-old ewe was examined at the Dessie City Administration Veterinary Clinic, South Wollo, Ethiopia, on February 23, 2023. The major complaints were lameness after ticks removed from the digits and reduced body weight fifteen days earlier.

Based on the owner's information, the conditions are mainly locally called "Mujelis" and frequently occur after a tick infestation around the digits. He had previously attempted to address the issues with the other sheep through minor surgical procedures without the use of medications. The ewe was managed under an extensive system with other sheep and goats, which were kept in the pasture for grazing during the day and housed in a protective shade during the night. The house was constructed from local materials with a non-concrete floor and cleaned two-three times a week. On physical examination, the rectal body temperature was 39.4 ^{O}C, and the respiratory and heart rates were 17 breaths per minute and 85 beats per minute, respectively. The status of dehydration and colour of the visible mucous membrane were in a normal state.

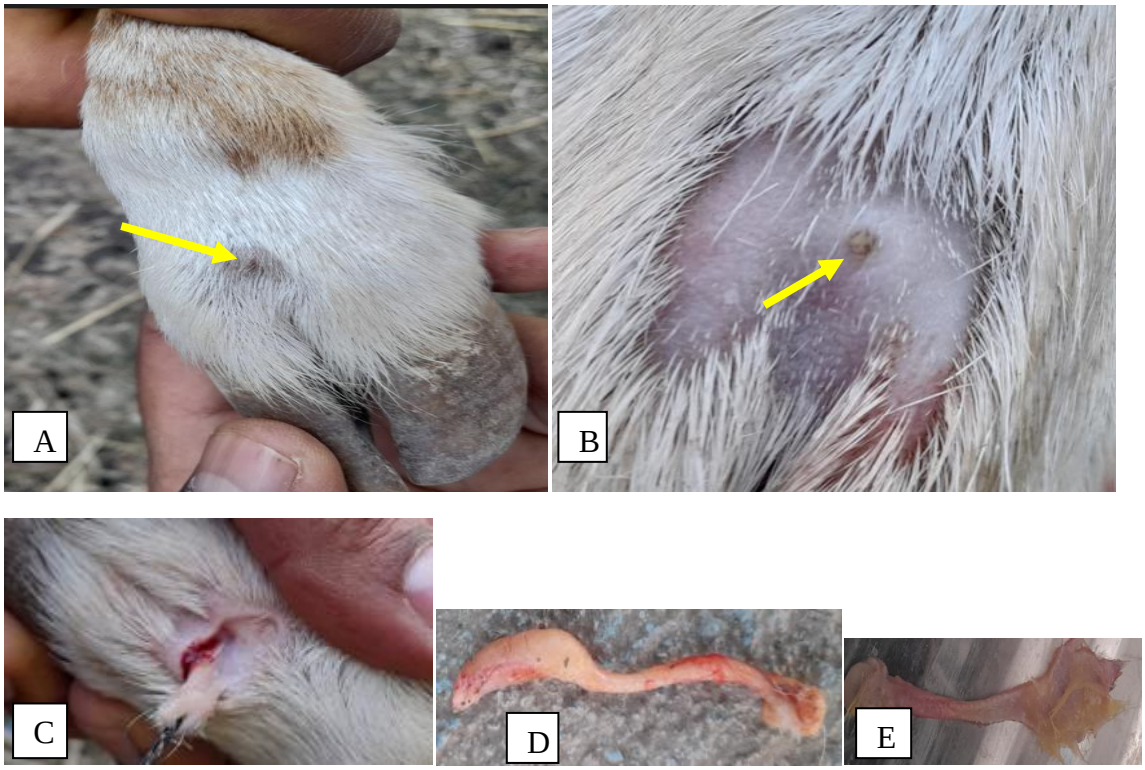

Figure 31: Interdigital space of the right anterior forefoot and the interdigital pouch. A raised dark spot (A), the orifice of the interdigital pouch with a discharge pathway to the outside from the affected skin (B), during surgical procedures (C), a lateral view of the interdigital pouch typically as a long pipe-like structure with a wide blind sac (D), and a longitudinal section of the inner lining of the pouch with tufts of hair and dirt (E).

The clinical examination of the ewe revealed lameness and painful swelling from the right forelimb, anteriorly at the dorsal aspects of the interdigital cleft. At the area, there was an opening with a sticky discharge pathway to the outside. The condition of the affected interdigital space of the right anterior foot is indicated in Figure 31A, B, and C.

Finally, based on history, clinical examination findings, the case was diagnosed as interdigital pouch lameness, and its management using surgical excision was performed.

Case management and treatment outcome

The case was managed by surgical removal of the interdigital pouch from the affected skin along with antibiotic treatment and disinfection. The surgical excision procedures were performed according to the standard procedures followed by Misk and Misk (2013). Accordingly, the ewe was restrained in lateral recumbency by the owner. The opening of the pouch on the affected area was selected, the hair was clipped off, and the area was thoroughly cleaned and disinfected. Lidocaine (1%) was infiltrated around the area. The orifice with the attached skin was grasped by needle fixed with a cut gut. A skin incision was performed around the orifice of the pouch using a scalpel blade. The tip of the orifice was pulled through circular and upward rotation with minimal force until complete extrusion of the pouch. Finally, the long, narrow, pipe-like structure with a wide blind sac was removed (Fig. 31D). The pouch was dissected out lengthwise, and physical examination revealed brown-like debris and white tufts of hair distributed across the pouch's interior lining (Fig. 31E).

The skin was closed using interrupted horizontal mattress sutures. The wound area was cleaned with 1% iodine until it showed good recovery. Oxytetracycline (Herbei Hobe Harmony Pharmaceutical Co. Ltd., China) IM, at 10 mg/kg body weight/day, once a day for three days, was given to prevent secondary bacterial complications. The owner was also advised to provide adequate nursing and keep the ewe at home until she is fully recovered. After five days of follow-up, the ewe was able to use the limb, and complete recovery was observed after ten days of post-treatment without any postoperative complications. Based on the owner’s information, there were no any unwanted troubles during a three month phone calling follow up period.

Discussion

In this case study, lameness associated with interdigital pouch was examined and managed in six-year-old sheep with a history of tick infestation around the digits. A common complaint among many farmers was the appearance of lameness in sheep when a tick was removed from the digits. This might be associated to the mechanical harm or injury the tick inflicted on the pouch. On the other hand, as the forelimb supports 60-65% of the bodyweight that makes it more vulnerable to stress and injuries than the hind limbs. The more severe the exercise demand, the more likely the sheep or its limb is to become lame (Bokko *et al*., 2003). Thus, when compared to the rear limbs, the forelimbs were more prone to lameness (Egwu *et al*., 1994). In keeping with this remark, lameness was detected in this case study from the right forelimb. The interdigital pouch has only been reported in sheep, deer, moufflon, and antelope; it was also uncommonly found in goats (Abdi *et al*., 2020). In addition, it is excluded as one of the main causes of lameness in goats (Awaad *et al.,* 2015). Therefore, this might be associated with the higher incidence of lameness in sheep than goat.

The interdigital pouch was situated at the first and second phalanxes, between the digits. Thus, the current investigation found that the anatomical position with the gross morphological feature of the interdigital pouch and its associated components matched those described by previous researchers (Sivachelvan *et al*., 1992; Atoji *et al*., 1988; Bokko *et al*., 2003; Yilmaz *et al*., 2018; Rajagopal *et al*., 2022).

Surgical removal of the interdigital pouch was previously recommended by Sivachelvan *et al*. (1992) and Oliveira *et al*. (2019). According to them, this allows to prevent infections and lameness. Similarly, according to Bokko *et al*. (2003), surgical removal of the affected pouch looks to be the most effective treatment and sheep were able to use the limbs 1-3 days post-treatment. Recovery within 3-5 days after treatment by surgical excision of affected cases was also reported (Egwu *et al*., 1994). However, surgical removal of the interdigital pouch is not described for controlling infection in Foot rot (Wassink *et al*., 2010). In this case study, the ewe used the limb after five days of post-treatment. The surgical wound heals without any trouble and the ewe had normal movement.

In conclusion, this case report indicated the clinical occurrence and useful management of lameness associated with interdigital pouch in sheep, but there are still gaps in the knowledge base that need to be filled. Therefore, conducting further study and training field practitioners on routine care and management of the case is also important to reach a popular standard of skill.

3.3. Compiled Clinical Case Report on Equine

3.3.1. Strangle in a donkey

Abstract

Strangles is a highly contagious and economically importance disease that affects the ' upper respiratory systems of equines. This case report study describes the case of strangle in male donkey in Dessie City Administration Veterinary Clinic. The donkey presented with complaints of weakness, reduced feed intake, presence of nasal discharge and coughing since two days. On physical examination the donkey was depressed, febrile with body temperature of 39.8 ^{O}C. The pulse rate was 74 beats/ minute and respiratory rate was 28 breaths per minute. There was bilateral mucopurulent nasal discharge with dried ruminants from the nostrils. The parasitological examination result of the fecal sample for lung worm infection was negative. The bacteriological laboratory result showed the presence of *Streptococcus* species, *Streptococcus equi.* Then, finally based on the history, observed clinical signs, laboratory findings the case was determined to be Strangle caused by *Streptococcus equi*. The donkey was treated with intramuscular administration of penstrep at 1ml per 20 kg body weight once a day for three successive days. The donkey was responded to treatment and recovered well. Therefore, Strangle is causing an economic impact due to cost of treatment and the need to restrain animals from their activities. In addition, the recovering and subclinical cases is represented the main important source for infection to susceptible animals. In conclusion, for this disease to be prevented, it is crucial to effectively identify and treat carriers.

Key words: *Donkey, Strangles, Streptococcus Equi.*

Introduction

In the developing world, there are an estimated 90 million horses, with the biggest populations found in central Asia and North and East Africa (Pritchard *et al*., 2005). China has the greatest population in the world with 11 million donkeys, closely followed by Ethiopia (Pritchard *et al*., 2005). The gradual rise of donkey populations around the world, particularly in developing countries, is linked to a number of anthropological phenomena, including the development of the human population, rising petrol prices, and the conversion of forest to farming (Barrandeguy and Carossino, 2018). However, there is a shortage of knowledge regarding the physiology, nutritional needs, health issues, and management practices of donkeys (Firew and Pal, 2015). One of the most significant diseases caused by bacteria that affect horses, donkeys, and mules is strangles. *Streptococcus equi subspecies equi*, a gram positive, beta haemolytic bacterium, is the cause of strangles and has been documented from various places (Firew and Pal, 2015). In previously a healthy but vulnerable population, the bacterium is highly infectious and causes significant morbidity but low fatality (Chhabra *et al*., 2023).

Strangles affects horses of all ages, but it is most severe in young animals (Barrandeguy and Carossino, 2018). It is disease of the upper respiratory system and is extremely contagious (Firew and Pal, 2015). Direct contact with nasal secretions or pus from sick donkeys or fomites can result in the transmission of the infection (Radostits *et al*., 2000). Strangles can also spread indirectly through dirty water troughs, sharing equipment, infected clothing, and hand-to-hand contact (Susanne, 2013). The persistence of *S. equi* and its transmission are significantly influenced by indiscernible carrier horses (Taylor and Wilson, 2006). *S. equi* adheres to the mucosa of the oropharynx and nasopharynx after entering through the mouth or nose. The bacteria only take a few hours to translocate into the nearby lymphatic structures, where they reproduce extracellularlly in the lymph nodes (Khurana and Dhama, 2016). Loss of appetite, depression, pyrexia, mucopurulent nasal discharge, and abscess formation in the lymph nodes of the head and neck are the disease's hallmarks (Chhabra *et al*., 2023). Other body organs can develop abscesses, and in 10% of cases, their rupture results in death; this condition is often referred to as "bastard strangles" (Khurana and Dhama, 2016).

Although outbreaks can happen at any time of the year but are more likely to occur in the cold weather (Faiefield, 2013).

Based on the history and clinical symptoms, strangle is diagnosed (Laus *et al*., 2007). However, to determine the exact diagnosis nasal swabs, abscess aspirates, or guttural pouch lavages are tested for culture or polymerase chain reaction (Baverud *et al*., 2007). Strangles can also be diagnosed using ELISA to detect blood protein and antibodies (Lefevre *et al*., 2010). Strangles should be clinically distinguished from other equine upper respiratory tract infections. It's important to distinguish between chronic weight loss caused by metastatic infection and neoplastic disease, parasitism, infectious anaemia, and poor nutrition (Sweeney *et al*., 2005).

The disease's stage and severity affect the course of treatment. Most affected horses can be properly treated with very basic supportive care, like rest in a warm, dry environment with access to soft, moist feed and clean water (Taylor and Wilson, 2006). When the disease is unpleasant and complicated, supportive penicillin therapies are useful (Sweeney *et al*., 2005). When administered to an animal in the early stages of the disease, treatment is typically successful and has no negative side effects (Davidson *et al*., 2008). NSAIDs are used as a supportive treatment to reduce swelling and to relieve pain (Songer and Post, 2005). The identification of carriers, proper cleanliness, the isolation of afflicted horses, and the prudent administration of immunizations are all essential to control and prevention (Timoney, 2007). Therefore, this case report study describes the case of strangle in male donkey.

Case description

A four years old male donkey was presented to the Dessie City Administration Veterinary Clinic on February 21, 2023 with complaints of weakness, reduced feed intake, presence of nasal discharge and coughing since two days. The donkey was kept in extensively with and sometimes used for cart purpose. Based on the owner information, one female donkey died with similar sign from his neighbours three weeks before. On physical examination the donkey was depressed, febrile with body temperature of 39.8 ^{O}C. The pulse rate was 74 beats/ minute and respiratory rate was 28 breaths per minute.

There was bilateral mucopurulent nasal discharge with dried ruminants from the nostrils (Fig. 32B). Based on the history and clinical findings the case was tentatively diagnosed as strangle with other bacterial and viral causes pneumonia and lung worm infection thought as the differential diagnosis.

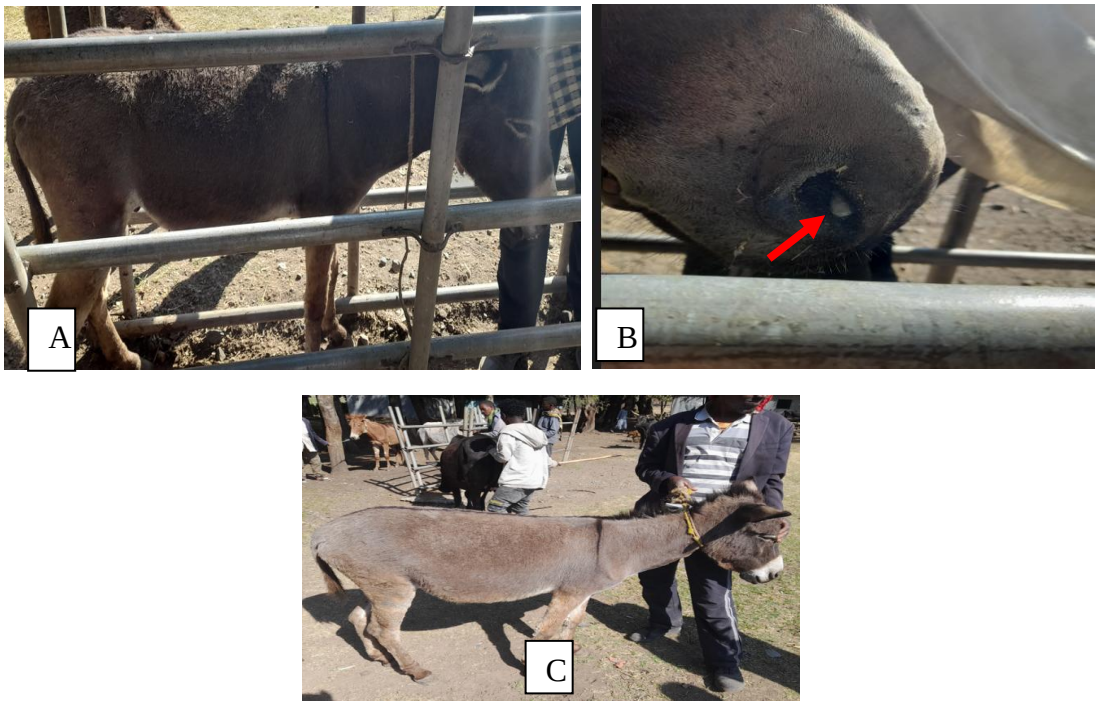

Figure 32: A donkey affected by strangles before and after treatment. Depression (A), mucopurulent nasal discharge (B), and the status of the donkey after twelve days of post treatment (C).

Laboratory investigation and findings

Accordingly nasal swab and fecal sample were collected for bacteriological and parasitological examinations, respectively. For parasitological examination of lung worm infection: A fecal sample was collected from the donkey directly from the rectum using sterile glove. The sample was immediately submitted to the parasitological units of Kombolcha Animal Disease Survey, Investigation, and Diagnostic Laboratory and processed on the day of collection for the recovery of the larvae using the modified Baermann technique. The faeces was enclosed in gauze and suspended in a glass filled with warm water.

It was allowed to stay overnight. Sample from bottom of the glass was collected in a petri dish and examined under a low power microscope. The parasitological laboratory test result shows no parasitic larvae were detected.

For bacterial examination: The nasal swab was collected after the outside of the nostril was disinfected by introducing a sterile cotton-tipped swab deep into the nostril and being gently rotated for around 30 seconds against the wall of the nasal cavity. Then the swab was removed and placed into a labelled sterile test tube that contains tryptose soya broth and is then kept in an ice box for immediate transport to the Kombolcha Animal Disease Survey, Investigation and Diagnostic Laboratory and incubated at 37 ^{O}C for 24 hours. After 24 hours of incubation, a loop full of the broth cultures was taken and streaked over blood agar medium supplemented with 7% sheep blood and incubated aerobically for 24 hours at 37 ^{O}C. After 24 hours of incubation, medium sized, mucoid and haemolytic colonies were observed on the blood agar medium (Annex 6). Then the sample was taken from the blood agar and again cultured on nutrient agar medium at 37 ^{O}C for 24 hrs for gram staining and catalase test.

On Gram's staining, gram positive cocci, arranged in chain were observed, which is the characteristic of the *Streptococcal* species. On catalase test, there was no bubble formed. Therefore, the bacterium taken from the nutrient agar was catalase negative. Thus, the laboratory result showed the *Streptococcus* species, *Streptococcus equi*. Then, finally based on the history, observed clinical signs, laboratory findings the case was determined to be Strangle caused by *Streptococcus* species, *Streptococcus equi*.

Case management and treatment outcome

The donkey was treated with intramuscular administration of penstrep at 1ml per 20 kg body weight once a day for three successive days. The owner was also recommended to refrain the donkey form work until recovered. The donkey was responded to treatment and recovered well. The condition of the donkey at ten days of post treatment is indicated in the Figure 32C.

Discussion

Strangles is a highly contagious and economically importance disease that affects the ' upper respiratory systems of equines (Chhabra *et al*., 2023). Clinical signs of strangles include fever, purulent nasal discharge, and abscessation of upper respiratory tract lymphoid tissues (Susanne, 2013). In the present case study strangle was diagnosed from male donkey with fever, depression loss of appetite and mucopurulent nasal discharge. These signs of strangle were documented by Faiefield (2013), Susanne (2013), and Al-Gharban (2017). The diagnosis was based on clinical sign and identification of the agent. Similarly, cases of strangle in donkey with nasal discharge as a clinical symptom were identified by (Firew and Pal, 2015). According to their clinical and microbiological findings, five of the nine donkeys who tested positive for *Streptococcus equi subspecies equi* had only nasal discharge. The absence of signs of abscessation of upper respiratory tract lymphoid tissues in the present case might be due to the atypical clinical symptoms associated with the several S. equi strains (Weese, 2014).

On the other hand, the severity of the disease significantly varies depending on the immune system of the animal (Sweeney *et al*., 2005). For example in horses, younger horses seem to display more severe clinical indications, including the formation and burst of lymph node abscesses, whereas older horses are frequently less seriously affected and recover more quickly. Despite the fact that most horses exhibit standard clinical symptoms, not all horses exhibit the same symptoms (Boyle *et al*., 2018).

Antimicrobial use can be controversial at times. Penicillin G is particularly effective against *S. equi sub species equi* and is advised to be administered at 22,000 IU/kg in the early stages of infection (Taylor and Wilson, 2006). In the present case, the donkey was recovered from the condition after treatment with penstrip for three successive days. Therefore, strangle is causing an economic impact due to cost of treatment and the need to restrain animals from their activities. In addition, the recovering and subclinical cases is represented the main important source for infection to susceptible animals (Al-Gharban, 2017). In conclusion, for this disease to be prevented, it is crucial to effectively identify and treat carriers.

3.4. Compiled Clinical Case Report on Chickens

3.4.1. Infectious coryza in chickens

Abstract

Infectious coryza is a well-recognized and commonly encountered upper respiratory tract disease in chickens throughout the entire world. In the present case, the disease was clinically diagnosed and managed in Kombolcha, South Wollo, Ethiopia, in four two month old Bovans brown chickens. Clinically, the chickens manifest conjunctivitis, swelling of the eye and surrounding tissue, sticky ocular discharge, a watery bubble around the corner of the eye, and a hard, condensed, cheesy exudates after a gentle pressing from the left eye. 10% enrofloxacin (Ashish Life Science Pvt. Ltd., India) was given with drinking water at a dose rat of 1ml of enrofloxacin per liters of water continuously for seven days. Ophthalmic ointment was used for five days to speed up healing. The cheesy exudate was pulled slowly until no remnants were observed. The owner was advised to wash the eyes with warm, sterile water. The chickens were fully recovered from the clinical signs. In conclusion, the information on infectious coryza in Ethiopia is very limited but as indicated in this case, it is a clinically encountered disease in chickens. Therefore, in order to reduce the economic loss caused by deaths or a decrease in productivity, the disease in the country should be further investigated.

Key words: *Chickens, Enrofloxacin, Infectious Coryza*

Introduction

Infectious coryza well-known and frequently occurring upper respiratory tract disease in chickens caused by the bacteria *Haemophilus paragallinarum* (Blackall, 1999) seen in many countries all over the world (Dereja and Hailemichael, 2017), particularly in tropical countries (Blackall *et al*., 2005). It is an infectious contagious bacterial disease of several avian species. Since the disease proved to be infectious and primarily affected nasal passages, the name "infectious coryza" was adopted (Rajurkar *et al*., 2009). The disease is a common economic illness that causes broilers to perform poorly in terms of growth and layer chickens to produce fewer eggs (Han *et* al., 2016).

The disease causes significant economic losses due to an increase in culling, a fall in egg production of 10–80%, a decrease in body weight, stunted growth, and occasional mortality of 2-10% (Blackall *et al*., 2005). Therefore, it is very important in developed and developing countries in chicken farm industry (Wahyuni *et al*., 2018).

The three main methods of transmission are direct contact, airborne droplets, and contaminated drinking water (Deresse, 2022). However, the transmission depends on infected carrier chickens because the agent does not survive long in the environment (Droual *et al*., 1990). Thus the disease may become endemic to an area as the recovered healthy birds or persistently infected birds act as source of infection in a population (Blackall and Soriano, 2005). In addition, it is highly opportunistic respiratory tract infection which is currently thought to be as a re-emerging disease of poultry birds (Deshmukh *et al*., 2015).

Common clinical symptoms include infraorbital swelling, oculonasal discharge, swollen wattles, diarrhea, lack of appetite (Dereja and Hailemichael, 2017), lacrimation, decreased feed and water intake, retards, reduces egg production in laying flocks and growth in young stock (Blackall, 1999). The concurrent infection with opportunistic pathogens such Mycoplasma gallisepticum or other septicaemia-causing bacteria eventually results in arthritis and septicaemia lesion in some of the rare clinical outcomes (Deshmukh *et al*., 2015).

Clinical signs, pathological abnormalities, and a history of rapid illness spread can all be used to make the diagnosis (Vegad and Katiyar, 2001). Demonstration of the organism on a bacterial culture is necessary for accurate diagnosis disease (Welchman *et al*., 2010). However, variables such as the co-occurrence of many respiratory diseases, an overgrowth of bacteria that grow quickly and hiding the growth of *H. paragallinarum*, the need for special media for culturing, and the presence of multiple biovars make a confirmed diagnosis challenging (Muhammad and Sreedevi, 2015). For quick and precise bacterial identification, advanced molecular approaches can be applied (Wahyuni *et al*., 2018).

For the management of the disease early antibiotic treatment is recommended. However, as many drugs have bacteriostatic effect on the organism, the disease may recur when medication is discontinued (Chukiatsirin and Chansiripornchai, 2008). However, the best strategy to prevent the disease is via all-in/all-out programs that have excellent management, good biosecurity, and the use of immunizations (Deresse, 2022).

In Ethiopia, prior assessment based on its clinical indications identified the disease as one of the most common chicken diseases in the nation by Reta (2009) including the study area (Wodegebriel *et al*., 2018). The presence of infectious coryza was confirmed by the isolation of *H. paragallinarum* by Dereja and Hailemichael (2017) from backyard chicken farms in Jimma, with the highest incidence of the disease observed during the months of January to April. The authors noted that the hottest and windiest nature of the area and the celebration of the popular holidays "Genna" and "Fasica" at this time of the year facilitate the ease of transmission of the microorganism. However, the record on infectious coryza in the country is inadequate. Therefore, the current case report presents the clinical management of infectious coryza in backyard bovans brown chickens in Kombolcha, South Wollo, Ethiopia.

Case description

The owner, Mohamed Yusuf, brought his four month old Bovans brown chickens to Kombolcha City Veterinary Clinic, Kombolcha, South, Wollo, Ethiopia, on January 12, 2023 with the history of reduced feed intake and swelling and watery ocular discharge on one eye for five days. One died within two days with similar lesions and signs. The appetite and weight of the chickens were reduced over time. The chickens were kept under a backyard management system around the homestead. Upon physical examination, rectal body temperatures ranged from 39.2 to 42.1 ^{O}C. The chickens were depressed. Conjunctivitis, Swelling of the left eye and surrounding tissue, which prevents the eye from opening (sticks together), sticky ocular discharge, and watery bubble around the corner of the eye were observed. Hard condensed cheesy exudates was oozed out and removed after a gentle pressing of the eye from only the left eye of one chicken. The clinical indications of infectious coryza are presented in Figure 33. The case was tentatively diagnosed as infectious coryza caused by the bacterium *H. paragallinarum*.

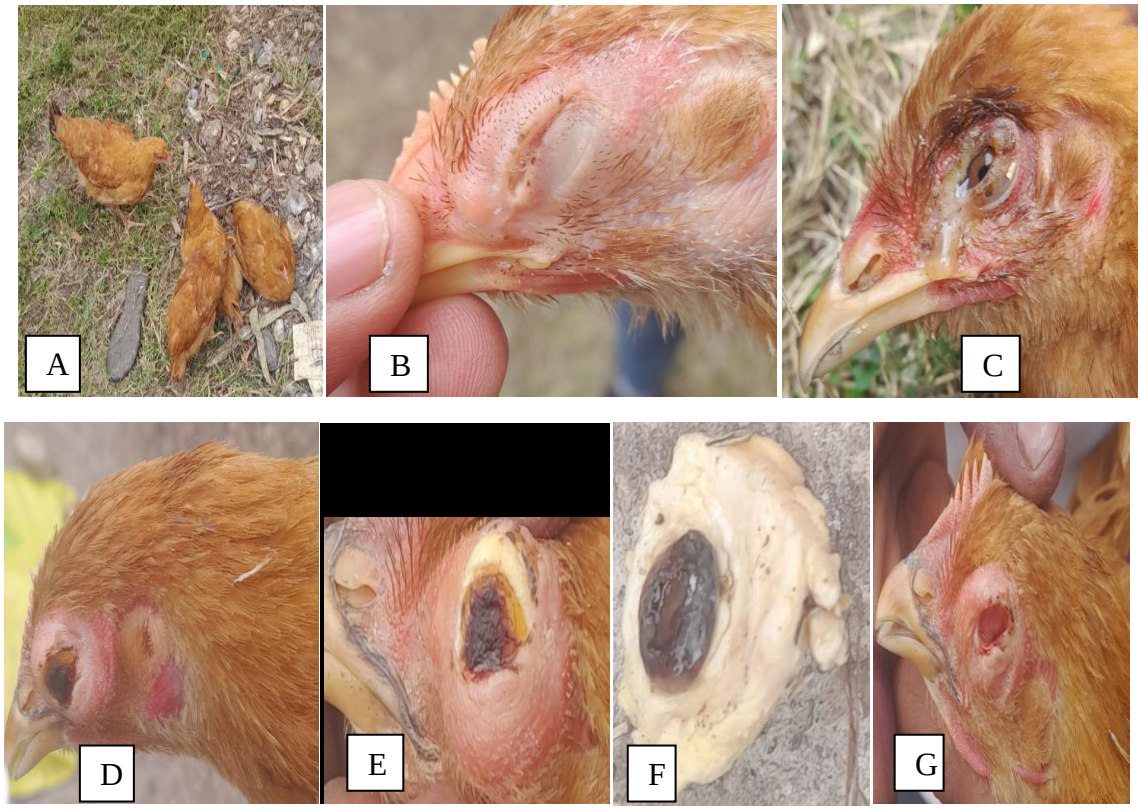

Figure 33: Different clinical indications of infectious coryza in the affected chicken. The depressed chickens (A), swelling of the eye and surrounding tissue with watery bubble (B), tick sticky ocular discharge (C), swelling with cheesy exudates from the left eye (D), oozed exudate after a gentle pressing (E), the removed cheesy exudate (F), and chicken head with devoid of the eye after the cheesy exudate removed (G).

Laboratory investigation and findings

Since *H. paragallinarum* is fastidious, slow-growing organism that is frequently outgrown by other, faster-growing organisms and needs the availability of specific conditions that can support the growth, laboratory isolation and identification are difficult. Finally, due to the absence of a laboratory facility, the case was diagnosed as infectious coryza based on history, clinical signs, and disease epidemiology and treatment by clinical management was started using antibiotics with supportive care.

Case management and treatment outcome

The chickens were permitted to undergo treatment to examine their response to treatment and their full recovery. Prompt antimicrobial treatments with supportive care were arranged to aid recovery. Accordingly, 10% enrofloxacin (Ashish Life Science Pvt. Ltd., India) was given with drinking water at a dose rat of 1ml of enrofloxacin per 1 liter of water continuously for seven days. Ophthalmic ointment was used for five days to speed up healing. The cheesy exudate was pulled slowly until no remnants were observed (Fig. 33F and G). The owner was advised to wash the eyes with warm, sterile water. After treatment, chickens were reserved for close observation by means of passive participation via mobile phone calls. Accordingly, the chickens were fully recovered from the clinical signs (Fig. 34) after two to three weeks of post treatment. Based on the owner's response, there was no recurrence of infections, and after three months of post-treatment, the chickens were sold at the local market.

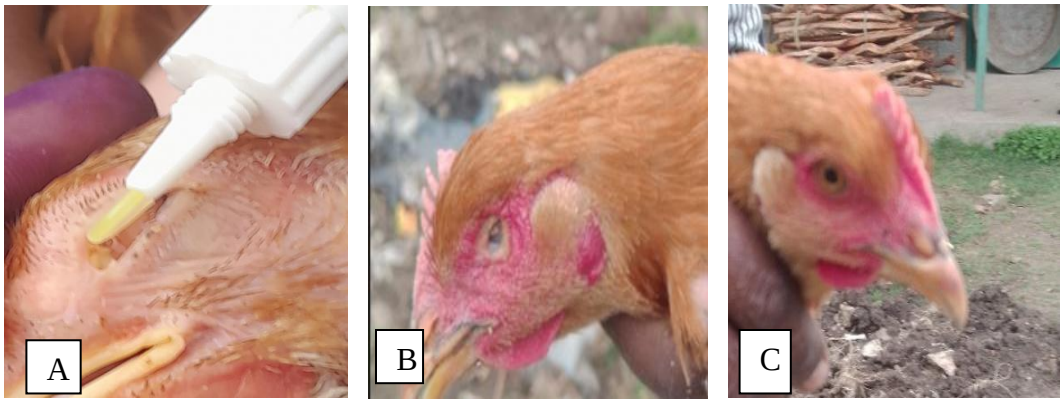

Figure 34: Indicating the chicken's eye and surrounding tissue during follow-up period. Application of eye ointment (A), the head recovered chicken with no eye ball (B) and a health right eye (C) at two months of the post treatment period.

Discussion

Infectious coryza is described as an upper respiratory tract disease that affects growing layer chicks between the ages of two and three months (Deshmukh *et al*., 2015). The disease can be diagnosed based on a history of rapid disease spread, clinical symptoms, and pathological changes (Vegad and Katiyar, 2001).

In the present case, the disease was clinically diagnosed in Bovans brown young chickens with manifestations of conjunctivitis: swelling of the eye and surrounding tissue, sticky ocular discharge, a watery bubble around the corner of the eye, and a hard, condensed, cheesy exudate after a gentle pressing of the left eye. These clinical signs were similar to those described by Deresse (2002).

In the present case, the diagnosis was based on history, clinical signs, and disease epidemiology. Among the differential diagnoses, the case was diagnosed as infectious coryza because, as mentioned by many authors, *H. paragallinarum infection is* frequently complicated by other viruses or bacterial infections (Crispo *et al*., 2019), mainly *Mycoplasma gallisepticum* infection (El-Naenaeey *et al*., 2021). Furthermore, the presence of the disease in the study area documented previously by Wodegebriel *et al*. (2018), the nature of the carrier infection, and the season of occurrence support the diagnosis of the case. As described by Dereja and Hailemichael (2017), the season is relatively hot and marked by popular holy days that may facilitate the transmission of the disease.

Clinical management of the chickens was undergoing antimicrobial treatment with supportive care with the aim of full recovery of the chickens and to reduce further dissemination of the microorganism. Enrofloxacin with drinking water was applied for seven days. The drug has a bactericidal effect, which helps to prevent carrier infections and recurrence when medication is discontinued. To speed up the healing, ophthalmic ointment was used for five days. The use of the bactericidal drug enrofloxacin in the management of infectious coryza was previously documented by (Deshmukh *et al*., 2015). The chickens responded to treatment and fully recovered without recurrence of infections.

In conclusion, the baseline data on infectious coryza in Ethiopia is very limited. As indicated in this case, it is a clinically encountered disease in chickens and is managed using bactericidal antibiotics. Therefore, in order to reduce the economic loss caused by death or a decrease in productivity, the disease information in the country should be further investigated.

3.5. Compiled Clinical Case Reports on Camel

3.5.1. Therapeutic management of camel mange

Abstract

The camel has received very little attention in contrast to other domesticated animals, especially in developing nations like Ethiopia. As a result, camels are susceptible to a number of illnesses, including mange mites. In the present study, a camel with the main owner's complaint of itching, rub against an object and kept extensively was treated clinically at the Kombolcha City Administration Veterinary Clinic. Upon physical examination the body temperature was 37.2 ^{O}C. The camel was emaciated and hair was rough. The clinical manifestations of the camel mange in the present study include hair loss on head, with skin crust around the lower flank, hind limb and thickening and corrugation of the skin of the inguinal area including skin of the prepuce. The case was tentatively diagnosed as camel mange. A sample of deep skin scraping was collected from suspected mange areas and examined under microscope for the presence of manage mite but the result was negative. The camel was treated with a combination of ivermectine injection at a dose of 1ml /50 kg body weight, SC, three injections, repeated 10 days distant and topical amitraz spray, given two times, each at midpoint of each ivermectine injections. The owner was advised to wash the camel with local detergent. Also, the owner was instructed to separate healthy camels from those that were contaminated, clean the fomites before and after usage, and treat the herds whenever one or more camels had clinical symptoms. The camel was respond to treatment and itching and rubbing were reduced from the second day of treatment. The skin returned to normal two months following the therapy**.** There was no recurrence of infestation within five months of follow-up. Therefore, using a combination of injectable and topical acaricides to treat camel mange appears to be more effective and can be recommended for use in managing mange infestation in other domestic animals. In addition, good housing management, sanitation practices, separating sick animals and avoiding sharing of the harness material were warranted for prevention of the mange infestation in camels.

Key words: *Amitraz, Camel, Ivermectine, Mange*

Introduction

Camels (Camelus dromedarius) are significant and useful animals in arid and semi-arid regions of the world (Al-Salihi and Al-Rammahi, 2014). This is because camel's unique physiological makeup enables them to play a significant role in desert farming (Bhagat *et al*., 2017). However, camels are constantly exposed to a wide range of harmful pathogens (Abdel-Saeed, 2020) including by different external parasites such as fly, tick and mange infestations (Oryan *et al*., 2008). Camel mange is one of the most significant veterinary issues in the majority of industrialized and developing nations (Kotb and Abdel-Rady, 2015). There have been reports of *Sarcoptes, Chorioptes* (Awol *et al*., 2014), Psoroptus, and *Demodex* mange mites in camels (Al-Hasnawy *et al*., 2022). However, *Sarcoptes scabiei var. cameli* frequently affect camels world-wide (Radostitis *et al*., 2007). In all species of camels, Sarcoptic mange is a serious condition that results in dermatitis with intense itching (Ngeiywa, 1992).

The mange primarily affects the camel's head, neck, flanks, inner side of the thighs, and inguinal area (Megersa *et al*., 2012). It is a highly contagious skin condition that results in hair loss, thickening and corrugation of the skin, scab formation, and pruritic dermatitis (Awol *et al*., 2014; Aziz *et al*., 2020). Camels with mange frequently exhibit indications of anaemia, subcutaneous oedema, emaciation, and debilitation (Ahmed *et al*., 2020). It can spread frequently among animals, through direct physical contact with an infected animal (Sazmand *et al*., 2019) or indirectly via infected fomites or physical objects such as trees, luggage and rugs (Ahmed *et al*., 2020). In Sarcoptic mange the entire life cycle of is completed in 17-21 days (Aziz *et al*., 2020). Adult male mite soon died after mating and female deposited eggs and died while they were incubating, leaving larvae that continued to consume serum exudation and skin debris (Abdel-Saeed, 2020), leading to itching , severe pruritus and pain (Al-Hasnawy *et al*., 2022). As a result, the animals often become malnourished as mange spreads because the itching prevents them from eating (Ahmed *et al*., 2020).

Camel mange is a parasite disease that has a significant economic impact and lowers production, if not treated properly (Feyera *et al*., 2015).

The economic worth of a mange-infested animal stems from the animal's lower body weight, the cost of treatment, the animal's skin deteriorating owing to skin perforation and acute itching, and occasionally dying in untreated or young animals (Kotb and Abdel-Rady, 2015). Moreover, mange can also significantly reduce the wellbeing of milking animals by lowering their vitality and making them more susceptible to other illnesses as a result of a secondary bacterial infection (Kotb and Abdel-Rady, 2015).

Mostly working diagnosis of camel mange is possible on the bases of clinical signs alone (Ngeiywa, 1992) which include severe pruritis, exudative dermatitis, scaly crust formation from parakeratosis, alopecia, and dark thickened skin (Jarso *et al*., 2018). Definitive diagnosis of mange is achieved by taking skin scrapings and identifying the causal mite (Ngeiywa, 1992). However, the sensitivity of this approach is low (Kamili *et al*., 2019).

Poor management and mixing sick and healthy camels are the main causes of the disease's occurrence (Jarso *et al*., 2018). Furthermore, factors like crowding, living conditions, and animal care are regarded as extrinsic variables and are likely the key to controlling and eradicating mange infestation in camels (Bhagat *et al*., 2017). An efficient procedure for managing camel mange and preventing re-infestation from the animal habitat includes the use of acaricides for the treatment of infected camels and pesticide spraying of the surrounding area (Kotb and Abdel-Rady, 2015). Therefore, the use of various acaricides formulations is the first treatment modality for mange. The second tool is good control measures, which include good housing management, adequate feeding and sanitation practices, proper manure disposal, and separating sick and sensitive animals (Abdel-Rady *et al*., 2021). According to reports, ivermectin is useful in treating ectoparasites in domestic animals, such as camels (Bhagat *et al*., 2017). This case study report presents about resolving clinical camel mange with administration of three doses of ivermectin 10 days distant along with topical amitraze spray at the midpoints of ivermectin injections.

Case description

Clinical care was performed on an adult camel presented to the Kombolcha City Administration Veterinary Clinic on December 24, 2022, with the main owner's complaint of itching and rubbing against any object. The camel was purchased one month earlier and kept under an extensive management system. Upon physical examination, the body temperature was 37.2 ^{O}C. There was hair loss on the head, and there was a hair loss and skin crust around the lower flank, hind limb including inside of the thigh.

Figure 35: Pre and post-treatment status of camel skin affected by camel mange. A camel under restraint (A), indicative clinical signs including hair loss, skin thickening and corrugation, rough hair coat with crust formation of the affected skin of lower flank, hind limb (B), and prepuce (C), showing improvement of the skin condition at 20 days of post treatment (D), and healed skin after three months (E).

There was thickening and wrinkling of the skin of the inguinal area, including the skin of the prepuce. The camel was emaciated, and its hair was rough. The clinical lesions represented are indicated in Figure 35A, B, and C.

Based on the history obtained from the owner and observation of indicative clinical signs, the case was tentatively diagnosed as camel mange.

Sample collection and laboratory findings

The parasitological examination protocol for the mange was adapted from Aziz *et al*. (2020).The camel was restrained properly and the hairs were clipped from the edges of the lesions with the help of scissors. Skin scraping was collected from edges of the lesions of flank and limb area with the aid of a scalpel blade. The sample was taken in petri dish and mixed with a small amount of 10% KOH solution to digest or clean the scraped material. The edge of the petri dish was smeared with paraffin so as to prevent the mites from escaping. Then it immediately transported to the parasitological unit of Kombolcha Animal Disease Survey, Investigation, and Diagnostic Laboratory for parasitological examination for the presence of mange mite. The mixture was then heated to digest the scrapings and release mites from the scabs. Finally, the specimen was placed on slide and examined under microscopic for the detection of the various stages of mange mites. But the result was negative.

Case management and treatment outcome

The treatment and control of mange mite infection using injectable macrocyclic lactones and topical amitraz were recommended by Corke and Matthews (2018). Accordingly, in this case study the camel was treated with a combination of ivermectine injection and topical amitraz spray. Ivermectin (1%) was given at a dose of 1 ml per 50 kg of body weight, SC, a total of three injections repeated 10 days distant. Topical 12.5 % amitraz (Uruguay) hand spray at a rate of 2 ml of amitraz for every 1 litter of water was given twice, one at the midpoint of each ivermectine injection. The owner was advised to wash the camel with local detergents. Also, the owner was instructed to separate healthy camels from those that were contaminated, and treat the herds whenever one or more camels had clinical symptoms.

Based on the owner's information, itching and rubbing were reduced from the second day of treatment, and skin condition improvement was observed one week after treatment. Skin condition improvement at 20 days post-treatment is indicated in Figure 35D. The owner's information obtained through a mobile phone call declared that the skin returned to normal two months following the therapy. The camel's general health had improved, and there was no longer any crust or thicker or corrugated skin after three months of post-treatment visits. In addition, hair regrowth from previously affected body parts and shiny skin were observed. Within five months of mobile phone follow-up, there was no recurrence of the infestation. The general condition of the camel skin at three months post-treatment is indicated in Figure 35E. Therefore, the clinical improvement following treatment supports the tentative diagnosis.

Discussion

In contrast to other domesticated animal species, the camel has received very little attention, especially in developing nations like Ethiopia. Hence, camels are susceptible to a number of illnesses, including mange mites (Jarso *et al*., 2018). In the present study, a camel with the main owner's complaint of itching/rub against an object and kept extensively was treated clinically at Kombolcha City Administration Veterinary Clinic. The recorded gross clinical manifestations of the camel mange in the present study include hair loss on the head, with skin crust around the lower flank, hand quarter, and head and inside of the thigh, and thickening and corrugation of the skin of the lower flank and inguinal area, including the skin of the prepuce.

The camel was emaciated in the present case study. This is due to the animals' itchiness, which prevents them from eating as mange develops (Ahmed *et al*., 2020). In contrast to this, the mange infestation had no impact on body condition (Abdel-Rady *et al*., 2021). Moreover, poor body condition in animals may be brought on by predisposing conditions such as Trypnosomosis, worm burden, and inadequate nutrition, as described by Jarso *et al*. (2018). The rectal temperature was 37.2 ^{O}C, which is lower than the report of Abdel-Saeed, (2020), a reading of 37.8 ^{O}C. The presence of hair loss, skin crust, thickening, and corrugation of the skin seen in the current report were in agreement with other previous authors (Awol *et al*., 2014; Zahid *et al*., 2015).

Anaemia and subcutaneous oedema were also documented by Amer *et al*. (2006) as common clinical signs of camel mange but not observed in the current case study.

The present case study indicated that the mange affected many parts of the body, including the head, flanks, thigh, and inguinal area, which was in agreement with Megersa *et al*. (2012). Abdel-Saeed (2020) in his study found skin lesions with prominent serum exudation that spread all over the body, including the head, forelimbs, and rump. *Sarcoptes scabiei var*. *cameli* was identified from skin scrapings in a previous study by Awol *et al*. (2014) in Ethiopia. The presence of mites in skin scrapings might be used to confirm the diagnosis of a suspected case of mange. However, the sensitivity of this approach is low (Kamili *et al*., 2019). The laboratory skin scrape test result was negative in this case study. This could be a result of the method's low level of sensitivity, which is caused by the sampler's skill, as well as the limited number of parasites and sites detected. Therefore, in this report, the diagnosis was based on the obtained history of itching, the observed clinical findings, and the treatment response to acaricides. According to Al-Hasnawy *et al*. (2022), itching is the primary clinical symptom of mange infestations, and the infestation can be predominantly identified based on clinical signs in camels. In addition, the camel was an adult and was kept in extensive care, which may be indicative of susceptibility due to involvement in work and grazing with infected camels.

The treatment and control of mange mite infection using injectable macrocyclic lactones topical amitraz were recommended by Corke and Matthews (2018). In the present study, camel mange was treated with a combination of ivermectine injection and topical amitraz spray to achieve a better cure rate. The ability of molecules for topical application to enter and adsorb may be dependent on by skin thickness or hyperkeratosis (Deak *et al*., 2021). Hence, as demonstrated by the current case study, topical amitraz may absorb well after subcutaneous ivermectine injections to eliminate the thick crust, suggesting that combination therapies are more successful. Similar treatment protocols for the use of combination therapy were documented and reported (Schosser and Fehr, 1989; Bala and Rath, 2006; Shekhar *et al*., 2020).

In addition, successful treatment of simultaneous sarcoptic and chorioptic mange through the use of subcutaneous ivermectine injection and topical amitraz with a chlorhexidine shampoo in alpacas was previously reported by Castilla-Castaño *et al*. (2021). Similarly, the study by Aziz *et al*. (2020) found that the application of combinations of four injections of ivermectine at 0.2 mg/kg and vetade at 10 ml per camel once weekly was more efficient to cure *sarcoptic* mange in camels than other trials.

In the present observation, healing of skin was remarkable and a full recovery of the animals was recorded after two month of post treatment. Abdel-Rady *et al*. (2021) found 100% cure level with doramectin injection and deltamethrin spray together. Disappearance of clinical signs of itching with parasitological cure noticed by 56 days post treatment was documented on the review by Jarso *et al*. (2018). Moreover, the general conditions of the camel also improved in post treatment observation and the owner was satisfied in this case study. In consistence with this result, improvement in clinical body condition after treatment of camel with ivermectine and diazinon to manage *sarcoptic* mange was reported in Ethiopia by Feyera *et al*., (2015).

In conclusion, as indicated in this case, the use combination therapies of injectable and topical acaricides for the treatment of mange in camel seem to be more effective and can be suggested for applied in the management of mange infestation in other domestic animals. Good housing management, sanitation practices, separating sick and sensitive animals and avoiding of sharing of the harness material were warranted for prevention of the mange infestation in camels.

3.5.2. Pneumonic pasteurellosis in camels

Abstract

Pneumonic pasteurellosis is a respiratory disease of animals including camels that cause significant economic loss. In the present case, two separate causes of pneumonic pasteurellosis from adult camels were diagnosed based on the history obtained from the owner, clinical presentations, and laboratory bacterial culture findings. The camels had history of reduction in feed intake, nasal discharge, and coughing. One of the camels was purchased two weeks before.

Both camels were kept extensively and involved in heavy agriculture work like carrying sugar cane from farm to market. Physical examination revealed fever, bilateral nasal discharge, difficulty in breathing, and partial blockage of the nostrils by discharges. The laboratory bacterial examination result showed the presence of *P. multocida*. The camels were treated with intramuscular injections of 10 % oxytetracycline (Shijiazhuang Zdhf Stock-Raising Co. Ltd., China) at a dose of 10 mg per kg body weight per day for three successive days. Both owners were also advised to keep the camels away from heavy workloads and any stressful factors to reduce the incidence of the disease. The camels were responded to treatment and recovered from the condition. In conclusion, early appreciation and treatment of Pneumonic pasteurellosis in camels with antibiotics are essential for successful management. The problem of drug resistance should be carefully monitored regularly to avoid treatment failure.

Key words: *Camels, P. multocida, Pneumonic Pasteurellosis*

Introduction

The one-humped camel is the only domesticated mammal with ecobehavioral adaptations for harsh, dry ecological zones (Khan, 2012). The camel has long been a neglected species among domestic ruminants (Tahamtan *et al*., 2016), while being relatively less vulnerable to many of the diseases that plague other livestock species in the same region (Khan, 2012). However, they were prone to many pathogenic agents, particularly the respiratory diseases (Abbas and Omer, 2005). Similarly, in Ethiopia respiratory illnesses have been a major threat for camel population (Awol *et al*., 2011). Among such diseases affecting camels, pasteurellosis is an extensive disease followed on by infection with the bacteria under the genus *Pasteurella* (Hussein, 2021). In addition to being frequent commensals of the upper respiratory tract of many domestic animals, *Pasteurella* species are significant primary and opportunistic infections (Subhash *et al*., 2012). Thus, under certain conditions, the bacteria can travel fast into the lungs and produce pneumonic pasteurellosis (Abebe, 2018). Commonly cause infection in camels as a result of adverse physical and physiological stress combined with viral and/or bacterial infections (Subhash *et al*., 2012) and due to impaired body defense mechanisms (Abubakar *et al*., 2010).

The common examples of stress factors includes extremely bad weather, transportation, poor management, overcrowding, or previous infection with respiratory viruses, Mycoplasma or other pathogenic organisms that essentially triggers the disease (Marinella, 2004). Therefore, majority of the infections are endogenous (Tadesse *et al*., 2017).

The bacteria are gram-negative, non-motile and non- spore forming, facultative anaerobic, small rods or coccobacilli (Holt *et al*., 1994) cells that are found singly, in pairs, or in short chains. Despite being Gram-negative, bipolar staining may be visible (El-Jakee *et al*., 2020). *Pasteurella* species are highly vulnerable to environmental factors, and intimate contact is an essential element in disease transmission (Wilkie *et al*., 2012). They are likely spread through the upper respiratory tract by inhaling infected droplets that are coughed up or exhaled by infected animals, either clinical cases or recovered carriers (Tadesse *et al*., 2017).

Pasteurella are widely spread and a major threat to livestock production in Ethiopia (Abebe, 2018) and thus pasteurellosis is an endemic health issues in the country (Jilo *et al*., 2020). According to Momin *et al*. (1987), camel *Pasteurella* exhibits a variety of septicaemia and pulmonary diseases. The most isolated pathogen from pneumonic animals is *Pasteurella multocida*; however *P. haemolytica* has also been linked to severe pneumonia (Megersa, 2010). Moreover, it is generally known that both organisms are the main etiological agents of numerous pasteurellosis epidemics (Mohammadpour *et al*., 2020). Like with, certain serotypes of *P. multocida* and *P. haemolytica* are linked to pneumonic pasteurellosis in camels (Hussein, 2021), which is also known as respiratory Mannheimiosis (Tadesse *et al*., 2017). *Mannheimia haemolytica* biotype A with serotypes A1, A2, and A7 are the most common, followed by A6 and A9, with A8, A12, A13, and A14 found in rare instances from Ethiopia (Jilo *et al*., 2020). The organism causes pneumonia, in stressed and/or immunocompromised animals and commonly called “shipping fever” (Highlander, 2001).

The disease has an acute febrile course with severe fibrinous or fibrinopurulent bronchopneumonia, fibrinous pleurisy, and septicaemia as its defining symptoms (Tadesse *et al*., 2017).

Dyspnea, crusty nose, ocular discharge, watery nasal discharge that ultimately turned into mucopurulent, and a fever of 40 ^{O}C-41 ^{O}C were present in pneumonic pasteurellosis (Gemeda *et al*., 2016). In addition, the clinical symptoms include depression, coughing, appetite loss, and finally, the camel would collapse with its neck stretched out straight over the ground, and some would get die within eight or nine days (Hanafy *et al*., 2022).

In general, the clinical indications, gross pathological lesions, isolation of the pathogens, and molecular characterization are used to make the diagnosis of the disease (Abebe, 2018). The clinical signs and pathological changes allow making preliminary field diagnosis (Laishevtsev, 2020). The employment of molecular methods is the most effective technique to control the disease and reduce economic losses (Amirgazin *et al*., 2019). As a result of its complicated multifactorial aetiology, pasteurellosis in camel is difficult to control, nonetheless, careful management, chemotherapy, and chemoprophylaxis are the most effective approaches (Aliyi, 2022). Good management and stress avoidance are the most effective preventative methods, while early diagnosis and antibiotic treatment are the most important approaches to illness control (Jilo *et al*., 2020).

In addition, there are many antimicrobial medications that can be used to treat acute pasteurellosis, including tetracycline, gentamycine, penicillin, ciprofloxacin, sulphonamides, and others (Hussein, 2021). Antibiotic treatment must be administered early in the disease's progression for it to be successful (Kasivalu *et al*., 2022). However, antibiotic resistance is common and the majority of this resistance is due to the widespread use of antibiotics in animal feed, both for prophylaxis and growth enhancement (Highlander, 2001). Even though, Pasteurellosis is endemic in Ethiopia, data regarding on the disease in camels were limited. Therefore, the current case report presents the clinical occurrence and treatment response of two separate causes of pneumonic pasteurellosis from adult camels.

Case description

Two separate adult camels were examined on February 7, 2023, at Harbu Veterinary Clinic, South Wollo, Ethiopia.

The chief complaints were of inappetance, nasal discharge, and coughing. One of the camels was purchased two weeks before. Both camels were kept extensively and involved in heavy agriculture work like by carrying and transporting sugar cane from farm to market. According to the physical and clinical examination, the rectal body temperatures were 39.9 and 40.1 ^{O}C, the respiratory rates were 24 and 26 breaths per minute, and the heart rate was 76 and 82 beats per minute. There were bilateral mucopurulent nasal discharge, and difficulty breathing. Partial blockages of the nostrils by discharges were noted during observation of the nasal cavity of the camels. One of the camels was depressed and emaciated. The clinical presentations of the camels are indicated in Figure 36.

Figure 36: Camels affected by pneumonic pasteurellosis. Bilateral mucopurulent nasal discharge (A and B), during taking nasal swab (C), during disinfection of the external nostrils by the help of the owner (D), and area of external nose of recovered camel after two weeks of post treatment (E).

Sample collection and laboratory findings

The nasal swabs from both camels were collected after the outside of the nostril was disinfected by introducing a sterile cotton-tipped swab deep into the nostril and being gently rotated for around 30 seconds against the wall of the nasal cavity. Then the swab was removed and placed into a labelled sterile test tube that contains 3 ml of Tryptone Soya broth and is then kept in an ice box for immediate transport to the Kombolcha Animal Disease Survey, Investigation and Diagnostic Laboratory and incubated at 37 ^{O}C for 24 hrs. After 24 hrs of incubation, a loop full of the broth cultures was taken and streaked over blood agar medium supplemented with 7% sheep blood and incubated aerobically for 24 hrs at 37 ^{O}C. After 24 hours of incubation, there were growths of round and non haemolytic colonies observed on the blood agar medium (Annex 6). Then the sample was taken from the blood agar and again cultured on nutrient agar medium for gram staining, catalase, oxidase, and indole tests and on MacConkey agar for growth at 37 ^{O}C for 24 hrs. After 24 hrs, there was no growth of colonies on MacConkey agar.

On gram's staining, coccobacilli, gram-negative bacteria, were appreciated under 100X microscope (Annex 6). On biochemical tests, the organism produces indole and is positive against the oxidase and catalase tests. Finally, by observation of the gram staining reaction, growth and colonial morphology on blood and absence of growth on MacConkey agar, and biochemical characteristics, it was concluded and interpreted that the isolates were *P. multocida.* Therefore, based on the history obtained from the owner, observed clinical signs, and laboratory findings, the case was finally diagnosed as pneumonic pasteurellosis caused by *Pasteurella multocida*.

Case management and treatment outcome

In parallel with sample collection, treatment with broad-spectrum antibiotics was arranged in order to relieve the camels of their problem. Hence, 10% oxytetracycline (Shijiazhuang Zdhf Stock-Raising Co. Ltd., China) at a dose of 10 mg per kg of body weight per day for three successive days was given intramuscularly for both camels. Both owners were also advised to refrain the camels from heavy workloads and to avoid any stressful factors to reduce the incidence of the condition.

One camel interrupted the third therapy, and based on mobile phone call response of the owner, the camel was fully recovered. On the third day of therapy, the second camel had recovered from nasal discharge, and full recovery was reported seven days later by phone call. At a two-week later visit, the camel was fully healed of the condition and was alert (Fig. 36E).

Discussion

Camels had been believed to be resistant to the majority of diseases that often affect cattle, but as more research was done, it came out that they are actually sensitive to many illnesses (Abbas and Omer, 2005), like pneumonic pasteurellosis. In the present case, pneumonic pasteurellosis was diagnosed based on the history obtained from the owner, clinical presentations, and bacterial culture findings. In many animals, Pasteurellosis can be diagnosed with a variety of clinical signs, ranging from rare coughing to sudden death and nasal discharge, inappetance, weight loss, and a high temperature in the 40.4 ^{O}C to 42 ^{O}C range with a history of stress like transportation (Radostitis *et al*., 2007). Similarly, in the current study, signs comprised of fever (39.9 and 40.1 ^{O}C), mucopurulent nasal discharge, and inappetance were revealed in adult camels with a history of heavy workload and one with history of purchasing from other area. These clinical signs were also in agreement with those previously observed by Hanafy *et al*. (2022) in camels in Egypt. A fever of 40-41.5 ^{O}C was recorded in camels with respiratory problems (Bekele, 1999). The clinical signs such as polypnoea, respiratory difficulty, nasal discharge, lethargy, poor appetite, and death within two to three days, were reported by Subhash *et al*. (2012) from a pneumonic pasteurellosis outbreak in camels.

In the current report, the identification of the organism was based on observation of the gram-staining reaction, growth and colonial morphology on blood and MacConkey agar, and biochemical characteristics of the organism on indole, oxidase and catalase test. The bacterial culture characteristics and biochemical reaction was compatible with the report described by Highlander *et al*. (2001), Subhash *et al*. (2012). Similar with the present report, Tahamtan *et al*. (2016) determined *P. multocida* as the main agent of camel respiratory disease.

However, *M. haemolytica* was isolated from the nasal discharge (Hanafy *et al*., 2022). Kebede and Gelaye (2010) reported the isolation of *M. haemolytica* from clinical cases with the history of coughing and nasal discharge at Kobo veterinary clinic, North Wollo, Ethiopia. On the other hand both *P. multocida* and *P. haemolytica* were isolated and identified by Aliyi (2022) from apparently healthy and pneumonic dromedary camels in Babile districts of the country. Thus, it is indicated that the two organisms have significant importance in the respiratory problem of camels in Ethiopia. Moreover, it suggests that the organisms are causing severe clinical symptoms and disease in camels. Hence, both the clinical manifestation and the isolation of the bacteria are due to the camel's affliction from predisposing factors like stress.

In the present study treatment with oxytetracycline were arranged aimed to relieving the camels from the problem and the camels responded to treatment and recovered well. Similar treatment arrangement was documented by Hussein (2021). The study by Subhash *et al*. (2012) found oxytetracycline and sulphadimidine were highly effective drugs in the treatment of pneumonia in camel. In conclusion, this case report indicated that pneumonic pasteurellosis is one of the clinical incidences in camel in the study area and early appreciation and treatment of the disease with antibiotics are essential for successful management. Thus, problem of drug resistance should be carefully monitored regularly to avoid treatment failure.

3.5.3. Diarrhea in adult camel

Abstract

Diarrhea is one of the largest health issues in the livestock industries including camels. This case report describes the clinical case of diarrhea and its treatment outcome in an adult camel. One humped adult camel was presented to Harbu Veterinary Clinic with complaints of inappetance, and watery feces. The camel was kept in an extensive management system in which it took its feed from a large area of pasture. Upon physical examination, the rectal body temperature was 37.5 ^{O}C and the camel was depressed.

There was release of profuse green diarrhea, which is smelly and soiled the rear quarter. Based on the history and clinical examination the case was tentatively diagnosed as Salmonellosis. Fecal samples were collected for bacterial culture and parasitic egg investigations. For the parasitological investigation, both fecal flotation and sedimentation were performed for detection of parasitic egg, and the results were negative. A bacteriological investigation of *Salmonella* species was performed. Based on the laboratory bacteriological culture and biochemical reaction the detected organism could be atypical lactose sucrose fermenting H_2S negative *Salmonella*. To ensure that an isolated strain is correctly demonstrated, a variety of biochemical, serological, and molecular assays can be applied on pure cultures. However, due to the absence of laboratory facility for further biochemical tests the case was finally diagnosed and reported as diarrhea. The camel was treated with oxytetracycline (10%) and ivermectin (1%) and intramuscular injection of Multi-Vitamin. The camel responded to treatment and looked to be getting well. Therefore, administrations of combinations of broad spectrum antibiotics and antiparisitic drug along with supportive treatment are recommended in the treatment of unidentified diarrhea in camels.

Key words: *Camel, Diarrhea, Treatment*

Introduction

In arid and semi-arid regions of the world, camels (Camelus dromedarius) are significant and useful animals (Al-Salihi and Al-Rammahi, 2014). This is because camel is particularly strong animal that is adapted both physically and physiologically to the harsh desert climate (Parsani *et al.*, 2008). However, many infectious and non infections disease affects the camel and leads to either reduce in performance or death. Some of these conditions have widespread clinical signs, such as diarrhea, while others only induce subclinical infections (Mohammadpour *et al*., 2020). Moreover, gastrointestinal disorders most likely diarrhea, are considered the commonest trouble associated with stresses and affects captivity and performance in camels (Sayed, *et al*., 1998).

Diarrhea is a condition characterized by a rise in the frequency, fluidity, or volume of feces (Marks, 2013). In terms of disease, diarrhea is a multifactorial condition that can have negative effects on both human and animal welfare (Muktar *et al*., 2015).

It can be caused through a variety of infectious agents, including bacteria, viruses, and parasites or is possible in response to alimentary factors (Miqueo *et al*., 2018). Numerous of these enteropathogens result in severe intestinal lesions, changes in enzyme activity, changes in the way nutrients are transported, or a combination of these effects (Holland, 1990). Infectious diarrhea is one of the largest health issues in the livestock industries (Foster and Smith, 2009). Some cases of diarrhea are self-limiting, whereas others are linked to high morbidity or fatality rates (Holland, 1990). Moreover, diarrhea can be inflammatory and noninflammatory based on the pathogenesis and clinical presentation (Navaneethan and Giannella, 2008). Regardless of the cause, diarrhea typically causes a significant loss of water and electrolytes because it damages the intestinal mucosa's morphology, making it more vulnerable to bacterial infection (Miqueo *et al*., 2018).

Salmonella and *Escherichia coli* species are the most prevalent and commercially significant bacterial causes of diarrhea in newborn food animals (Muktar *et al*., 2015). Diarrhea, weight loss, and death within a few weeks are the symptoms of chronic Salmonellosis in camels (Mohammadpour *et al*., 2020). There are numerous *Salmonella* serotypes that can inflict clinical Salmonellosis in animals including camels (Nour-Mohammadzadeh *et al*., 2010). The diagnosis of Salmonellosis is based on the identifications of the agent (Demirbilek, 2017. The appearance of *Salmonella* on various plating media must be recognized and must also be alert to atypical colonies, such as non-hydrogen sulphide (H_2S) producers (Wray and Wray, 2000).

In camels if diarrhea is not promptly treated, it may cause it to die from anaemia (Gupta *et al*., 2015). A clear diagnosis or histological characterization of intestinal biopsies serves as the foundation for particular therapeutic approaches of diarrhea (Marks, 2013). Young calves can often be recovered from injury or illness with supportive therapy in the form of oral or intravenous fluid delivery of balanced electrolyte solutions and provision of sufficient nutrition (Holland, 1990). The main goal of treatment for diarrhea is to restore fluid and electrolyte deficiencies. The oral rehydration solutions help the jejunum

to absorb salt, water and other nutrients more rapidly (Schiller, 2000). This case report describes the clinical case of diarrhea and its treatment outcome in an adult camel.

Case description

One humped adult camel was presented to Harbu Veterinary Clinic on February 2, 2023, with complaints of inappetance, and watery feces since one day. The camel was kept in an extensive management system in which it took its feed from a large area of pasture. Upon physical examination, the rectal body temperature was 37.5 ^{O}C and the camel was depressed. There was release of profuse green watery feces, which is smelly and soiled the rear quarter (Fig.37B). Based on the history and clinical examination findings, the case was tentatively diagnosed as diarrhea caused by Salmonellosis, with among its differential diagnosis being other bacterial infections, viral, and internal parasite infection. Accordingly, samples were collected for bacterial culture and parasitic egg investigations.

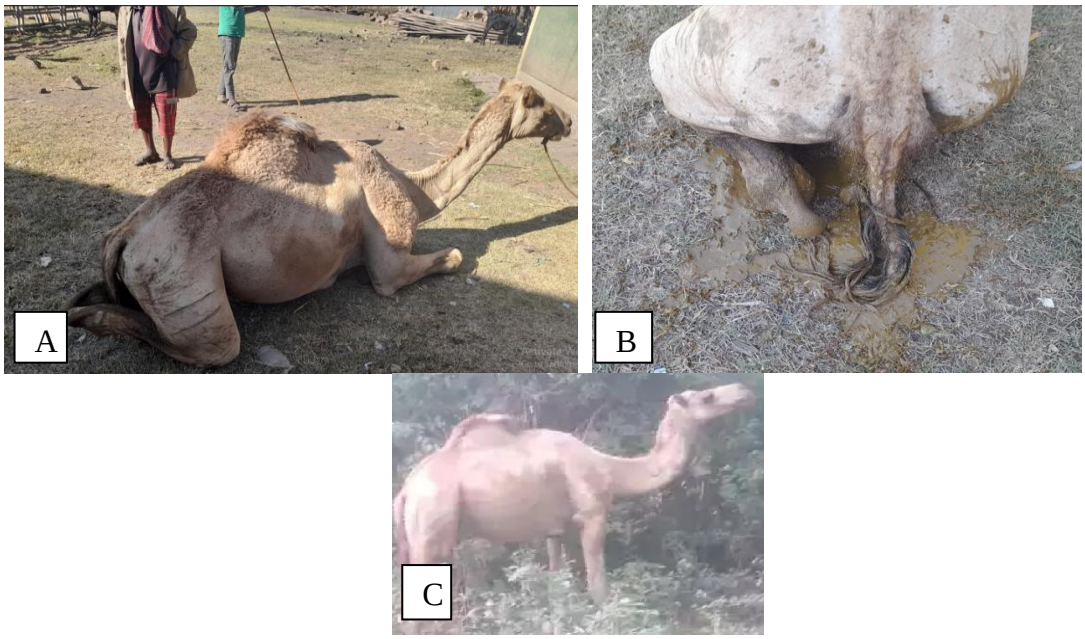

Figure 37: A camel with profuse watery feces. The camel in sternal recumbency (A), profuse watery feces (B), recovered camel (C).

Laboratory investigation and findings

Fecal sample was aseptically collected from the camel and sent to the Kombolcha Animal Disease Survey, Investigation, and Diagnostic Laboratory for further bacterial and parasitic investigations. For the parasitological investigation, both fecal flotation and sedimentation were performed for detection of parasitic egg, and the results were negative. For bacteriological investigation, the sample was enriched in tryptone soya broth and incubated for 24 hours at 37 ^{O}C. After 24 hrs, a portion of 0.1 ml of pre-enriched culture was aseptically transferred to test tubes containing 10 ml of rappaport-vasiliadis *Salmonella* enrichment broth and incubated for 24 hr at 37 ^{O}C. A loop full of inoculum from rappaport vassiliadis broth was transferred and streaked onto the surface of xylose lysine deoxycholate (XLD) and brilliant green agar (BGA) base separately. The plates were incubated for 24 hours at 37 ^{O}C and then examined for growth of colonies of *Salmonella*. On xylose lysine deoxycholate agar, yellow colonies without the characteristic blackening centre (Fig. 38); whereas on BGA, colourless colonies were observed.

For further identification and confirmation the colonies were randomly picked and sub cultured again on nutrient agar at 37 ^{O}C for 24hrs. Growth on MacConkey agar and gram staining, oxidase, triple sugar iron, indole, methyl red, and citrate utilization tests were performed. On MacConkey agar growth of small non lactose fermenting colonies were observed. On gram staining, gram negative coccobacilli organisms were appreciated. The triple sugar iron test result showed yellow butt/ yellow slant without hydrogen sulphide production. The biochemical reaction showed indole and citrate test positive results but negative for oxidase and methyl red tests. Based on the laboratory bacteriological culture and biochemical reaction the detected organism could be atypical lactose sucrose fermenting H_2S negative *Salmonella*. To ensure that an isolated strain is correctly verified, a variety of biochemical, serological, and molecular assays can be applied on pure cultures. However, due to the absence of laboratory facility for further biochemical tests the case was finally diagnosed and reported as diarrhea.

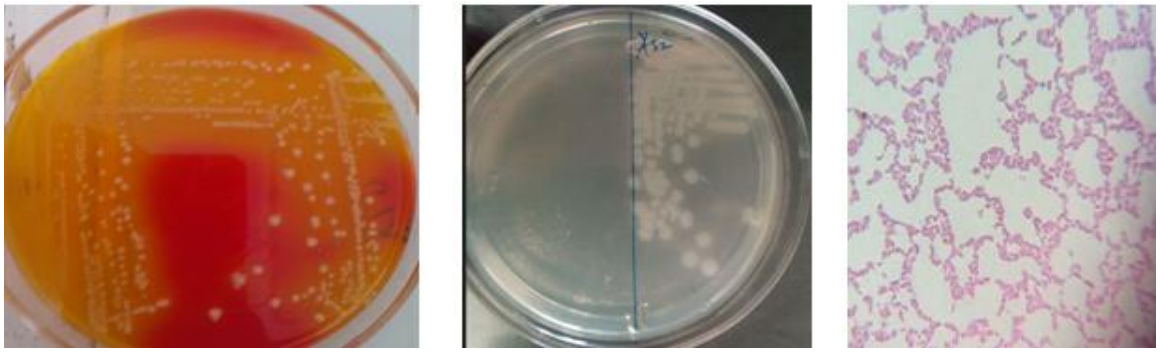

Figure 38: Growth of bacterial colony on xylose lysine deoxycholate agar and nutrient agar and its gram staining reaction (left to right).

Case management and treatment outcome

As the laboratory confirmation takes long time and the cause being managed immediately, empirical therapy with broad spectrum antibiotic and antiparisitic drug was arranged. Oxytetracycline 10% (Shijiazhuang Zdhf Stock-Raising Co, Ltd., China) IM, at a dose rate of 10 mg per kg once daily for three successive days and ivermectin (1%) at a dose rate of 1ml per 50 kg, stat were given. In addition, 15 ml of Multi-Vitamin (Aether Centre Biology Co, Ltd., China) IM, injection was given to restore the appetite of the camel. The owner also informed to provide access to fresh water and keep the camel in house. The camel health showed improvement after the next day of treatment and was fully recovered from the condition (Fig. 37C).

Discussion

Like other animals camel is affected by various changes of the environmental condition such as change of ration, food and water scarcity, management stress, transportation, environmental pollution. Diarrhea is the commonest disorder associated with such stress factors (Sayed, *et al*., 1998). Generally, viruses, bacteria, and protozoa are thought to be the main causes of diarrhea in the majority of causes. In the present case an adult camel was examined with profuse watery diarrhea. Passing of frequent watery feces as sign of diarrheal disorder was documented by Gupta *et al*. (2015). According to Diab *et al*. (2002), diarrhea is the primary cause of economic loss in camels due to treatment cost, poor growth, and animal mortality.

Even though it was not finally confirmed by the laboratory test result, in the current case, Salmonellosis was suspected based on the history and clinical findings. The signs of Salmonellosis include profuse, watery, fetid diarrhea (pender, 2003). These signs were also noted in the present instance. *Salmonella* had previously been isolated from camels with diarrhea by Seddek *et al*. (1996) and Mohammadpour *et al*. (2020). The feed itself might be suggested as a source of *Salmonella* infection in the camel. In this regard, the presence of *Salmonella* from camel feed was documented by Wray and Wray (2000) and Mohammadi and Najafi (2017).

Practice of treatment of diarrhea in camels with buttermilk and salt by the local healers was documented in India (Gupta *et al*., 2015). In the present case the camel was treated with broad spectrum antibiotics and an ivermectine with intramuscular Multi-Vitamin injection. The camel responded to treatment and looked to be getting well. The diarrhea was stopped from the next day of treatment. Therefore, administrations of combinations of broad spectrum antibiotics and antiparisitic drug with supportive treatment are recommended in the treatment of unidentified diarrhea in camels. However, the causes of diarrhea in adult camel should be fully recognized by future detailed research.

3.6. Overall Descriptions of the Current Case Reports

A total of 19 different cases comprised of 39 total animals were compiled in these case reports through clinician examination and laboratory test results. From the compiled cases of animals 13/39(33%), 20/39 (51%), 4/39(10%), 1/39(3%) and 1/39(3%), were cattle, sheep and goats, camels, donkey and chickens, respectively. Therefore, more than half of the examined animals were sheep and goats. The overall result of the current case study was summarized in table 2.

Table 2: Total number of compiled cases and animals examined with treatment outcome.

No	Animals	Total examined (%)	Recovered (%)	Death (%)
1	Cattle	13(33)	9 (69)	4 (31)
2	Sheep and goat	20(51)	18 (90)	2 (10)
3	Camel	4 (10)	4 (100)	0 (0)
4	Chickens	1 (3)	1 (100)	0 (0)
5	Donkey	1(3)	1 (100)	0 (0)
6	Total (%)	39(100%)	33(85)	6 (15)

In addition, the result revealed, from a total of 39 animals, good prognoses were obtained in 33/39 (85%) of the cases, whereas 6/39(15%) of the animals were died. Therefore, as indicated by this case report, early treatment and uncomplicated cases were having higher chance of recovery.

When the case report was being put together, an effort was made to include from each disease-causing agent. Accordingly, from the total numbers of compiled causes, 6/19 (32%), 5/19 (26%), 4/19 (21%), 1/19 (5%), and 3/19 (16%) were caused by bacteria, viruses, parasites, metabolic issues, and other alignments, respectively. The result showed that both infectious and non-infectious animal health problems are importantly present in the study area.

Table 3: Number of affected animals with causative agent.

No	Diseases	Number of cases (%)	Number of affected animals (%)
1	Bacterial	6 (32)	12 (31)
2	Viral	5 (26)	16 (41)
3	Parasitic	4 (21)	7 (18)
4	Metabolic	1 (5)	1 (3)
5	Others	3 (16)	3 (8)
6	Total	19	39

Moreover, procaine penicillin G, oxytetracycline, penstrip, sulphamethoxazole-trimethoprime, ivermectine, Multi-Vitamin, albendazole, triclabendazole, amitraze, diclof enac and dexamethoxasone sodium phosphate were among the prescribed medications during the study period in the study area.

4. CONCLUSION AND RECOMMENDATIONS

The current case study looked and identified the occurrence of clinical cases of different species of animals including cattle, sheep and goat, donkey, and camel in the study area. Various disease markedly infectious (parasitic, bacterial, viral) and non infectious diseases were demonstrated based on the histories, clinical indications, and laboratory test results. It revealed the direct and indirect economic losses by morbidity, mortality, and poor performance of the animals irrespective of the age, sex, breed, production system of the animals. In addition, the study showed early treatment of the case with appropriate handling protocols would have better treatment out come. Therefore, study gives suggestion about recognition of the commonly found clinical incidents of veterinary importance in the study area. However, due to inadequate laboratory facilities, the diagnosis in some cases was made only on the basis of clinical indicators. This study did not included the biochemical and haematological change, connected to each instance, which may have provided a better hint for explanation of the cases. The challenges of this case study were outlined as, absence of fully equipped laboratory facility, treatment interruption, and the uncooperativeness of some owners. Limited medication options present another challenge during the study period. Based on the above conclusions the following recommendations are forwarded;

- Increase public awareness mainly for animal owners on vaccination and early detection and treatment of diseased animals. Additionally, animal owners should be encouraged to report any signs of the disease to the local authorities.
- In the study area clinical cases of animlas were sometimes treated at the house without laboratory conformations. Therefore, drugs should be given to animals wi th confirmed cases.
- Adequate investment in veterinary service and resources including the laboratory facilities and diagnostic aides, manpower, drugs, materials and equipments is required from both the government and animal health actors for better handling of diseased animals in the study area.
- Continuous and comprehensive studies should be conducted on the detailed clinical characteristics of the disease of veterinary importance.

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6. ANNEXES

Annex 1: Informed consent with the owner

My name is Asmamaw Bihonegn, second year veterinary clinical medicine student from Addis Ababa University, College of Veterinary Medicine and Agriculture. I am temporarily working here to conduct a research with the objective of compiling clinical cases on selected clinical diseases of veterinary importance. The study has benefits for the community to document cases and detailed report of the symptoms, signs, diagnosis, treatment, and follow-up of an individual patient included in each case reports. The study has periods of until the animal got recovered. First you will find the informed consent then I'm going to ask you some very questions that are related to the disease conditions on your animal. Your answers are completely confidential. Your name, mobile phone number and address will be written on this form and will be used in connection with any of further information either by phone communication or house visit regarding on the treatment, follow up and recording the outcome. You do have to answer all questions that i do want to ask you and this may end after a time of recording patient/s outcome. However, your honest answers to these questions will help me better understand about the disease condition and treatment out come on this animal. Can i go ahead? i would greatly appreciate your help in responding to this conversation. Are you willing to participate?

Annex 2: Methods used in clinical examination, adapted from Abdisa (2007), Jackson and Cockcroft (2002), and Tefera (2004).

The diagnosis comprised on owner's complaint (including signalment), handling and restraining, patient signalement, through medical history, general and specific clinical examination, making differential diagnosis, and further laboratory diagnosis.

- Signalment: includes the identification number, breed, age, sex, and production class of animal.
- Patient history: For completeness and accuracy of history taking, the following check lists comprised of immediate/present history, past history, management and environment history were considered.

- what are the signs?, when did the signs start, how did the signs develop?, previous medical history?, receiving any medication at the moment?, eating and drinking normally?, urinating and defecating normally?, any recent changes in the environment?, did any other individuals get sick or die?, e.t.c.
- Handling and restraining: How do we safely and humanely handle an animal?

General clinical examination:

- From the distance: Inspection, a visual examination of the animal's body posture/behaviour, nutritional status, care condition, breathing rate, dirt, wounds, ectoparasites, e.t.c.
- On the animal: Palpation, percussion, auscultation, body temperature, mucosa, capillary refill time, skin turgor test e.t.c.
- Palpation: the application of firm pressure with the fingers to tissues to determine characteristics such as abnormal shapes and possible tumors, the presence of pain and tissue consistency.
- Percussion: the application of a short, sharp blow to a tissue to provoke an audible response from body parts directly beneath.
- Auscultation: the act of listening to sounds that are produced by the body during the performance of functions (e.g., breathing, intestinal movements).
- Recording of rectal temperature: Recording of body temperature of animal is most important in clinical diagnosis. Temperature should be recorded while the animal is at rest. The rectal temperature was recorded in animals by inserting the bulb of a clinical thermometer in the rectum, placed in contact of the rectal mucosa and keeping it for one to two minutes. Then thermometer reading will reveal if the temperature of animal being examined is normal, above normal (fever) of below normal (subnormal). Based on this finding action taken were vary.
- Recording of heart/ pulse rate: Heart rate was taken from the cardiac area and auscultating the heart and counting the beats per minute. Site for recording pulse: middle coccygeal artery, ventral coccygeal artery under the tail, facial artery, maxillary and median artery; femoral arteries.

- Recording of respiratory rate: it was counted from the thoracic area over a period of 1 minute before the animal is restrained for examination. Inspiratory or expiratory movements of the chest wall or flank were also counted.
- Examining the skin: grasp the skin of the upper part of the body and notice the elasticity.
- Capillary refill time (CRT): This is taken by compressing the mucosa of the mouth or vulva to expel capillary blood, leaving a pale area, and recording how long it takes for the normal pink color to return. In healthy animals, the CRT should be less than 2 seconds. CRT of more than 5 seconds is abnormal, and between 2 and 5 seconds it may indicate a developing problem. An increase in CRT may indicate a poor or failing circulation causing reduced peripheral perfusion of the tissues by the blood.
- Examination of visible mucous membrane: This includes the examination of conjunctiva, buccal, nasal, vulval, vaginal and rectal mucosae. In normal and healthy condition of animals, the mucous membrane is moist and rosy in coloration. The following changes of mucous membrane are seen in unusual conditions of animals.
    - ✓ Congestion: Signs of fever and inflammation, systemic diseases and allergic sensitization.
    - ✓ Paleness: Revealing anaemia, internal haemorrhage, hypoproteinaemia, excessive blood loss and shock.
    - ✓ Yellow discoloration: Signs of ecterus and hepatic disorder jaundice. Pin point/Petecheal haemorrhages: Indicates septicaemia, surra, phosphorus and arsenic poisoning.
    - ✓ Cyanotic changes: Bluish discoloration owing to dyspnea, hypoxia, venous stasis, congestive cardiac failure, pleurisy and nitrate poisoning.
    - ✓ Ulcerations: Typical ulcers on oral mucous membrane seen in FMD and PPR .
- Special clinical examination: includes examinations of the hair, skin, mucosa, lymphatic system, cardio-vascular system, respiratory system, digestive system, urinary-and reproductive system, nervous system and sense organs, and musculoskeletal system.

The normal rectal temperature of pulse rate, respiratory rate, capillary refill time and colour of conjunctiva of the examined species of animals is shown in the following table.

Animal species	Normal rectal temperature (°C)	Pulse rate (Beats/Minute)	Respiratory Rate (Breaths/ Minute	Capillary refill time	Colour of Conjunctiva
Adult cattle	37.8-39.2	60-90	25-30	<2 seconds	pink
Calve	38.5-39.8	100-120		<2 seconds	pink
Adult horse	37.2-38	28-42	8-16	<2 seconds	pale roseate
Foal	37.5-38.5	70-80		<2 seconds	pale roseate
Sheep	38.5-40	68-90	10-20	<2 seconds	pink
Goat	38.6-40.2	68-90	10-20	<2 seconds	pink
Chicken	41.7	200-400	15-30		
Camel	35.7-38.9	35-50	9-16	<2 seconds	

Annex 3: Clinical case recording form (AAU, CVMA).

Date:_____

Site/Name of the clinic:_____ Address:_____

Owner's name:_____ Address:_____, Phone number:_____

Patient identification: Species:_____, Breed:_____, Sex:_____,

Age:_____, Color:_____,special markings:_____

History: Past and immediate history, environment, management and feeding, number of affected and at risk, place of origin etc.:_____

_____

General physical examination: Temperature:_____ Heart rate:_____

Respiratory rate:_____ , Visible mucous membrane:_____,

Rumen motility, _____,etc:_____

Systemic physical examination: detailed examination of the affected system;_____

_____

Tentative diagnosis:_____, Sample taken:_____, Laboratory test methods employed_____, Definitive diagnosis_____,

Prognosis_____, Treatment: Drug_____, Dose_____, Route_____,

Follow-up_____.

Control and prevention: control methods prescribed, prevention and corrective management measures recommended_____

_____

Annex 4: Parasitological examination procedures for fecal samples

Laboratory procedure for fecal flotation test

The feces was collected from the rectum and sent to the laboratory with 10% formalin. Around 3 gm of the faces was measured in a beaker. 50 ml of floatation fluid was added. The faeces and water was mixed thoroughly. The solution was strained through tea strainer. The test tubes were placed in a test tube rack. The test tubes were gently topped up with the filter solution until convex meniscus formed. Gently cover slip was placed on top of the test tubes. The test tubes were left for 20 minutes. Carefully the cover slip was lifted off from one test tube, together with the drop of fluid adhering to it, and it was placed immediately on a microscope slide. The slides were then observed under microscope (10X). The preparation revised repeatedly three times.

Laboratory procedure for fecal sedimentation test

The feces was collected from the rectum and sent to the laboratory with 10% formalin. About 3 g of feces was mixed with 42 ml of tap water using mortar and pestle. The suspension was filtered through a Sieve into a beaker. The filtered material was poured into centrifuge tubes (not filled to the top) and centrifuged at 1500 rpm for 3 minutes. The supernatant was decanted. Using a pipette some of the sediment was removed from the top layer and a drop was placed on a slide for examination. The sediment was stained by adding one drop of methylene blue. The cover slip was placed over the drops and examined under a microscope at 10X magnification. The preparation revised repeatedly three times.

Annex 5: Bacteriological examination procedures

Gram staining procedure

A drop of sterile water was placed on a clean labelled microscopic slide with a sterile cooled loop. The inoculation loop was heated again with Bunsen burner until it becomes red hot and allowed to cool. Colony from nutrient agar was touched with inoculating loop and gently stirred into the drop of saline water on the slide to create an emulsion. Smear was made on a clean glass slide. The smear was air dried and heat fixed by passing through flame quickly 3 times. The smear was flooded with crystal violate and waited for 1 minute. The slide was rinsed with cold tap water and drained. The slide was flooded with gram's iodine and allowed to remain for 1 minute. Rinsed with tap water and drained. It was decolorized with acetone for 20 seconds, then rinsed with tap water and drained. Counter stained with gram's safranin for 1 minute; rinsed with tap water and dried. A drop of oil immersion was added on the stained slide and it was examined fewer than 100X objective lens of binocular microscope.

Slid catalase test procedure

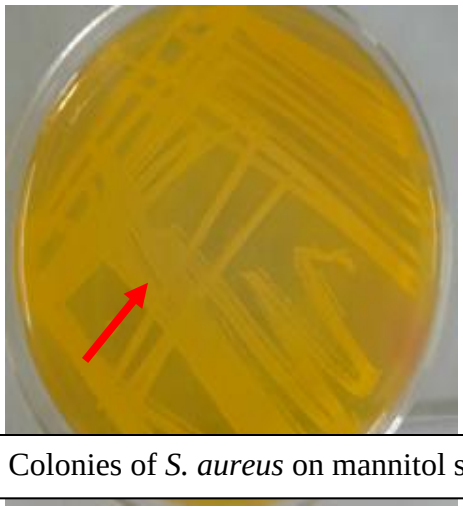
The inoculation loop was heated with Bunsen burner until it becomes red hot and allowed to cool for few seconds. A loopful of the bacterial growth was taken from the top of the colonies and placed on the on microscope slide. A drop of 3% hydrogen peroxide was added in the glass slide. The mixtures were observed for generation of bubbles and interpreted as either catalase positive if bubble formed or catalase negative if no bubble formed within few seconds.

Procedure for indole test

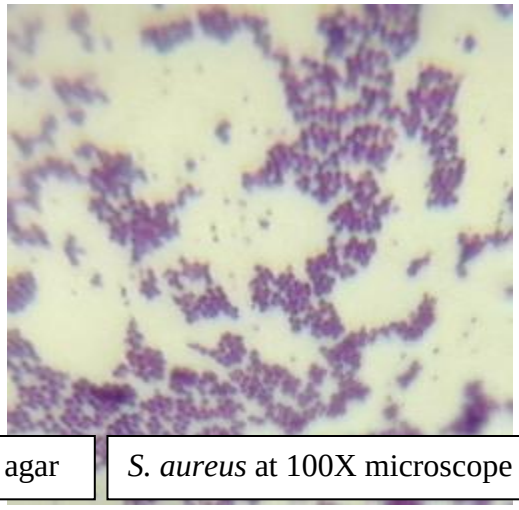
The inoculating wire loop was flamed by using a Bunsen burner and cooled for few secon ds. The mouths of tryptone broth test tube and nutrient agar petri plate were flamed. A colo ny was picked up from the nutrient agar by the inoculating wire loop and immediate ly transferred into Tryptone broth. The mouth of tryptone broth tube was flamed once agai n.

It was inoculated at 37 ^{O}C incubator for 24 hrs. After 24 hrs of incubation, 3 drops of Kov ac's reagent was added. The presence of red ring floating above the culture medium (pos itive result) was checked.

Annex 6: Bacteriological culture result.

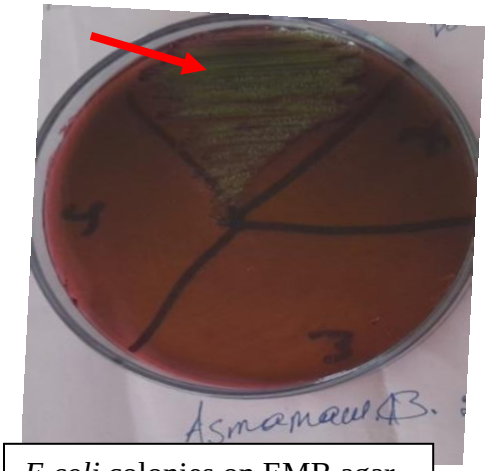


Colonies of *S. aureus* on mannitol salt agar



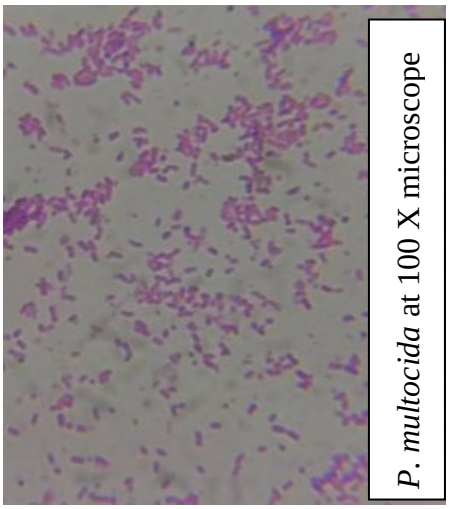
S. aureus at 100X microscope

E.coli colonies on MacConkey agar

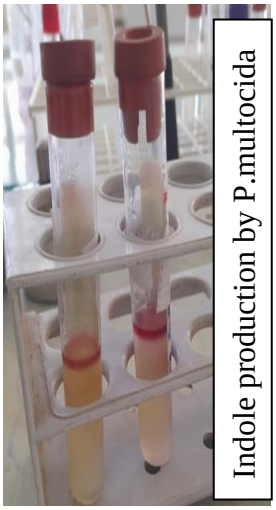


E.coli colonies on EMB agar

P. multocida on blood agar



P. multocida at 100 X microscope



Indole production by P.multocida

Annex 7: Additional images taken during the study period

During microscopic examination

Group of sheep and goats at PPR vaccination site

During cleaning and disinfection of necrotized skin of a calf affected by Lumpy skin diasease.

During visiting the recovery status of a camel affected by camel mange

Annex 8: Summary of species, age, sex, management system, and etiologic agent composition of the compiled cases of animals during the study period.

No	Disease	Examination area	Species	Age	Sex	No of cases	Management system	Agent
1	Clinical mastitis	KCAVC	Cattle	A	F	1	Intensive	Bacteria
				O	F	1		
			goat	A	F	1	Extensive	
2	LSD	KCAVC	Calves	Y	F	5	Intensive	Virus
					M	1		
3	FMD	KCAVC+ DCAVC	Cattle	A	M	2	Intensive/Semi-intensive	Virus
					F	1		
4	LSD+ FMD	KCAVC	Cattle	A	F	1	Intensive	Virus
5	Pink eye	KCAVC	Goat	Y	M	1	Extensive	Bacteria
				A	F	2		
		HCAVC	Sheep	Y	M	1	Extensive	
6	PPR	KCAVC	Goat	Y	M	3	Extensive	Virus
7	Pox	HCAVC	Sheep	A	F	1	Extensive	Virus
			Goat	A	M	2	Semi-intensive	
8	Coenurosis	KCAVC	Goat	Y	M	1	Semi-intensive	Parasite
9	Dystocia	KCAVC	Goat	Y	F	1	Extensive	Other
10	Colibacilosis	KCAVC	Goat	Y	F	1	Extensive	Bacteria
11	Lameness	DCAVC	Sheep	A	F	1	Extensive	Other
12	Fashiolosis	DCAVC	Sheep	A	F	2	Extensive	Parasite
		KCAVC	Cattle	A	M	1	Extensive	
13	Parasitosis	DCAVC	Sheep	Y	F	1	Extensive	Parasite
		KCAVC	Goat	Y	F	1	Extensive	
14	Bloat	KCAVC	Sheep	A	M	1	Semi-intensive	Metabolic
15	Mange	HCAVC	Camel	A	M	1	Extensive	Parasite
16	Pasteurellosis	HCAVC	Camel	A	M	2	Extensive	Bacteria
17	Diarrhea	HCAVC	Camel	A	M	1	Extensive	Other
18	Strangle	DCAVC	Donkey	A	M	1	Extensive	Bacteria
19	Coryza	KCAVC	Chicken	Y	F	1	Backyard	Bacteria
20	Total					39		

Keys: No= Number, A= Adult, Y=Young, O= Old, M=Male, F= Female, KCAVC= Kombolcha City Administration Veterinary Clinic, DCAVC = Dessie City Administration Veterinary Clinic, HCAVC= Harbu City Administration Veterinary Clinic.