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**ADDIS ABABA UNIVERSITY**  
**COLLEGE OF VETERINARY MEDICINE AND AGRICULTURE**  
**DEPARTEMENT OF CLINICAL STUDIES**



**CLINICAL CASE STUDIES ON MAJOR DISEASES OF LIVESTOCK AND EVALUATION  
OF SMART PHONE BASED APPLICATION AS A DIAGNOSTIC TOOL IN AND AROUND  
BISHOFTU AND MODJO TOWNS, CENTRAL ETHIOPIA**

**MVSc THESIS**

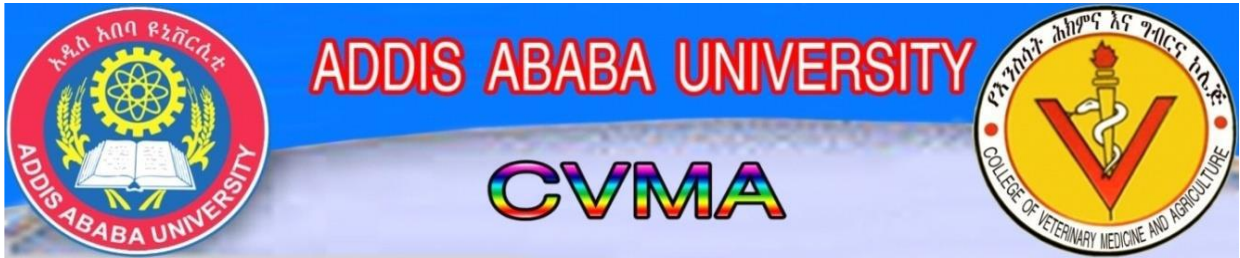
**By:**

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**JUNE, 2021**

**BISHOFTU, ETHIOPIA**

ADDIS ABABA UNIVERSITY  
COLLEGE OF VETERINARY MEDICINE AND AGRICULTURE  
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SMART PHONE BASED APPLICATION AS A DIAGNOSTIC TOOL IN AND AROUND  
BISHOFTU AND MODJO TOWNS, CENTRAL ETHIOPIA

A Thesis Submitted to the College of Veterinary Medicine and Agriculture of Addis Ababa University  
for partial fulfillment of the requirements for the degree of Master of Veterinary Science in Veterinary  
Clinical Medicine

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First, I declare that this thesis is my original work and that all sources of materials used for this thesis have been duly acknowledged. This thesis has been submitted in partial fulfillment of the requirements for an advanced (MVSc) degree at the Addis Ababa University and is placed at the University library to be made available to borrowers under the rules of the Library. I solemnly declare that this thesis is not submitted to any other institution anywhere to award any academic degree, diploma, or certificate.

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## TABLE OF CONTENTS

Contents	Pages
<b>ACKNOWLEDGMENTS</b> .....	III
<b>LIST OF TABLES</b> .....	IV
<b>LIST OF FIGURES</b> .....	V
<b>LIST OF ANNEXES</b> .....	VII
<b>LIST OF ABBREVIATIONS</b> .....	VIII
<b>ABSTRACT</b> .....	IX
<b>1. INTRODUCTION</b> .....	1
<b>2. STUDY METHODS AND MATERIALS</b> .....	4
<b>2.1. Study Area</b> .....	4
<b>2.2. Study Design and Population</b> .....	4
<b>2.3. Case Handling Protocols</b> .....	5
2.3.1. <i>History taking and examination of animals</i> .....	5
2.3.2. <i>EDDIE Smart phone based application disease diagnosis</i> .....	6
2.3.3. <i>Laboratory investigation</i> .....	6
<b>3. COMPILED CASES</b> .....	7
<b>3.1. Case Reports on Bacterial Diseases of Livestock</b> .....	7
3.1.1. <i>Caseous Lymphadenitis; a case of a sheep and its management</i> .....	7
3.1.2. <i>Colibacillosis (Calf scour); a case of exotic breed calves and its treatment outcome</i> .....	13
3.1.3. <i>Clinical Mastitis due to Klebsiella (Coliform mastitis); a case of lactating exotic breed cow</i> .....	20
3.1.4. <i>Dermatophilosis (cutaneous streptothricosis); a case of an ox and its treatment outcome</i>	27
3.1.5. <i>Bovine salmonellosis; its management and treatment outcome in ox</i> .....	33
3.1.6. <i>Management of Staphylococcus aureus caused Abscess; a case of cross breed ox</i> .....	40
3.1.7. <i>Infectious Bovine Keratoconjunctivitis (Pink eye); a case of a cow and its management</i> ..	46

3.1.8. <i>Malignant Edema (Gas gangrene); a case of an ox</i> .....	52
3.1.9. <i>Pneumonic pasteurellosis (Mannheimiosis); a case of a ram and goat</i> .....	58
<b>3.2. Case Reports on Parasitic Diseases of Livestock</b> .....	65
3.2.1. <i>Ascariasis; a case of a horse and its treatment outcome</i> .....	65
3.2.2. <i>Haemonchosis; a case of six sheep from a flock</i> .....	71
3.2.3. <i>Bovine trypanosomosis; its management and treatment outcome in an ox</i> .....	79
3.2.4. <i>Mange (Allergic dermatitis); a case of a calf and its treatment outcome</i> .....	85
3.2.5. <i>Bovine fasciolosis; a case of a cow</i> .....	91
<b>3.3. Case reports on Viral Diseases of Livestock</b> .....	97
3.3.1. <i>Newcastle Disease; Its postmortem and other diagnostic findings in hens</i> .....	97
3.3.2. <i>Parvoviral infection in a puppy; its treatment outcome with combined antibiotic and supportive therapy</i> .....	103
3.3.3. <i>Foot and Mouth Disease; a case of young bull and early lactating cow</i> .....	109
<b>3.4. Case reports on Non-infectious Diseases of Livestock</b> .....	115
3.4.1. <i>Milk fever/ clinical hypocalcaemia; a case of ewe and its management and treatment outcome</i> .....	115
3.4.2. <i>Subcutaneous benign tumour; a case of an ox and its management</i> .....	122
<b>3.5. Case reports on Concurrent Diseases of Livesock</b> .....	128
3.5.1. <i>Concurrent diseases of clinical coccidiosis and enteric colibacillosis; a case of a doe and its treatment outcome</i> .....	128
<b>4. OVERALL RESULTS AND DESCRIPTION OF THE CURRENT STUDY</b> .....	135
<b>5. CONCLUSION AND RECOMMENDATIONS</b> .....	139
<b>6. REFERENCES</b> .....	140
<b>7. ANNEXES</b> .....	178

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**LIST OF TABLES**

**PAGES**

**Table 1:** Total number of animals examined in relation to recovery rate, death and postmortem examination..... 135

**Table 2:** Cases examined during the study in relation to etiologic agent in percentage. .... 136

**Table 3:** Cases examined during this study in association of study areas and etiologic agents..... 137

**Table 4:** Evaluation of EDDIE App-based diagnosis with clinician/expert diagnosis and corresponding laboratory confirmation..... 138

## LIST OF FIGURES

## PAGES

<b>Figure 1:</b> Picture of the sheep affected by caseous lymphadenitis before and after therapy. ....	10
<b>Figure 2:</b> Laboratory results of caseous lymphadenitis suspected sheep .....	11
<b>Figure 3:</b> Pictures of calves affected by colibacillosis.....	16
<b>Figure 4:</b> Pictures indicating lab result of colibacillosis suspected calves .....	18
<b>Figure 5:</b> Status of the calves after third day therapy .....	19
<b>Figure 6:</b> Picture of the cow affected by mastitis with its milk .....	24
<b>Figure 7:</b> Laboratory result of mastitis affected cow .....	25
<b>Figure 8:</b> Picture of dermatophilosis suspected ox .....	30
<b>Figure 9:</b> Laboratory result of dermatophilosis suspected ox .....	31
<b>Figure 10:</b> Picture of ox suspected by salmonellosis .....	36
<b>Figure 11:</b> Laboratory results of salmonellosis from the ox .....	37
<b>Figure 12:</b> Status of the ox during IV fluid substitution and after three weeks post therapy .....	38
<b>Figure 13:</b> Picture of the ox suspected with subcutaneous abscess at the ventral side of dewlap. ....	42
<b>Figure 14:</b> Laboratory results of the ox from abscess case .....	43
<b>Figure 15:</b> Evacuation of the abscess.....	44
<b>Figure 16:</b> Status of the ox following management and follow up after two weeks.....	44
<b>Figure 17:</b> Picture of the cow with IBK.....	49
<b>Figure 18:</b> Laboratory results of IBK suspected cow .....	50
<b>Figure 19:</b> Picture of recovered cow from IBK after 45 days post therapy.....	51
<b>Figure 20:</b> Picture of Malignant edema suspected ox.....	55
<b>Figure 21:</b> Laboratory result of the ox affected by Malignant edema .....	56
<b>Figure 22:</b> Pictures of Mannheimiosis suspected ram and goat .....	61
<b>Figure 23:</b> Laboratory results of Mannheimiosis suspected ram and goat.....	62
<b>Figure 24:</b> Recovered ram after a month. ....	63
<b>Figure 25:</b> Diagrammatic representation of life cycle for equine ascariasis.....	66
<b>Figure 26:</b> picture of the horse infected by ascaris .....	68
<b>Figure 27:</b> Picture of laboratory result of the horse from ascariasis .....	69
<b>Figure 28:</b> Recovered and active horse after therapy.....	69
<b>Figure 29:</b> Diagrammatic representation of life cycle of ovine haemonchosis.....	73
<b>Figure 30:</b> Haemonchosis suspected sheep.....	75

<b>Figure 31:</b> Faecal floatation result of haemonchosis suspected sheep.....	76
<b>Figure 32:</b> Intravenous rehydration of severely affected ewe.....	77
<b>Figure 33:</b> Diagram of a trypanosome .....	80
<b>Figure 34:</b> Picture of the ox suspected by trypanosomosis infection.....	82
<b>Figure 35:</b> Laboratory result of trypanosomosis suspected ox .....	83
<b>Figure 36:</b> Recovered ox from trypanosomosis after two months.....	84
<b>Figure 37:</b> Picture of the calf suspected by mange (arrows indicate lesions in different sites).....	88
<b>Figure 38:</b> Laboratory result of the sample taken from the calf suspected by mange. ....	89
<b>Figure 39:</b> Status of the calf after one and two months respectively.....	90
<b>Figure 40:</b> The life cycle of fasciolosis.....	93
<b>Figure 41:</b> Picture of a cow with bottled jaw indicating bovine fasciolosis. ....	95
<b>Figure 42:</b> Fasciola egg observed under microscope from fecal sedimentation.....	95
<b>Figure 43:</b> Recovered cow from fasciolosis after a month. ....	96
<b>Figure 44:</b> Pictures of suspected hens with Newcastle disease (greenish diarrhea and torticollis). .	100
<b>Figure 45:</b> Pathological changes of hens due to NCD at post-mortem examination .....	101
<b>Figure 46:</b> Picture of laboratory result .....	102
<b>Figure 47:</b> Picture of canine parvovirus infection suspected dog .....	106
<b>Figure 48:</b> IV fluid substitution for losses due to CP.....	107
<b>Figure 49:</b> Recovery of the puppy after therapy with intensive follow up .....	108
<b>Figure 50:</b> Pictures of FMD suspected bull and cow .....	112
<b>Figure 51:</b> Pictures indicating recovery of lesions due to FMD affected animals.....	113
<b>Figure 52:</b> Picture of ewe affected by hypocalcaemia .....	119
<b>Figure 53:</b> IV administration of calcium borogluconate and its response after 20 minutes .....	120
<b>Figure 54:</b> Picture of recovered and delivered ewe with its lamb after a day.....	120
<b>Figure 55:</b> Picture of the ox suspected with subcutaneous benign tumor .....	124
<b>Figure 56:</b> Cytological result of excised tumor from the ox by modified wright stain.....	125
<b>Figure 57:</b> Pictures indicating surgical removal of subcutaneous benign tumor from the ox .....	126
<b>Figure 58:</b> Picture showing recovery of the ox with disappearance of the swollen mass after two (left) and three (right) weeks.....	126
<b>Figure 59:</b> Picture of doe suspected with concurrent infection by coccidiosis and colibacillosis ....	131
<b>Figure 60:</b> Laboratory results of coccidiosis and colibacillosis suspected doe.....	132
<b>Figure 61:</b> Picture of the doe during and after therapeutic management .....	133

**LIST OF ANNEXES**

**PAGES**

**Annex 1:** Addis Ababa University, CVMA veterinary case handling format.....178  
**Annex 2:** Clinical case handling protocols .....178  
**Annex 3:** Biochemical laboratory results of some of the bacteria in this study.....181  
**Annex 4:** Form of smart phone based EDDIE Application as disease diagnosis and treatment aid.....182

## **LIST OF ABBREVIATIONS**

AAU	Addis Ababa University
CPV	Canine Parvovirus
CLA	Caseous Lymphadenitis
CVMA	College of Veterinary Medicine and Agriculture
EMB	Eosin Methyelene Blue
EDDIE	Ethiopian Differential Diagnosis and Information Environment
FMD	Foot and Mouth Disease
GDP	Gross Domestic Product
IBK	Infectious Bovine Keratoconjunctivitis
IBR	Infectious Bovine Rihinotrachitis
IM	Intramuscular
IV	Intravenous
ME	Malignant Edema
MVC	Modjo Veterinary Clinic
NAHDIC	National Animal Health Diagnostic and Investigation
ND	Newcastle Disease
NSAID	Non Steroidal Anti-inflammatory Drugs
PCV	Packed Cell Volume
PVD	Parvoviral Disease
PCR	Polymerase Chain Reaction
TRP	Traumatic Reticulo Pericarditis
TSB	Tyryptone Soya Broth
VTH	Veterinary Teaching Hospital
VTM	Viral Transport Media
XLD	Xylosine Lysine Deoxycate

## **ABSTRACT**

Despite the large livestock population and relative diversity of animal species in Ethiopia, the current output to provide enormous contributions to the people's national economy and livelihoods is less, which can be due to extensive prevalence of animal diseases. Therefore, the objectives of this work were to handle and organize case reports, and evaluate the accuracy of smart-phone-based App as a diagnostic and treatment aid tool on selected clinical cases of livestock presented to VTH and MVC in and around Bishoftu and Modjo towns from November 2020 to June 2021. This case study described that different animal species with different ages, sex and breed groups with different physiological statuses were examined based on history, detailed physical and clinical examinations and by using EDDIE smart-phone App. Animals were treated and managed promptly with antimicrobials, supportive drugs and combination based on recommendations of the manufacturer on the basis of tentative diagnosis. Alongside, appropriate samples from these animals were collected and processed in the laboratories for confirmation. The cases were followed either in the animal health services during therapies or at home until recovery. A total of 20 different clinical cases comprised of 31 total animals were examined in which 80.6% (25/31) were ruminants and 19.4% were others (equine, canine and poultry). From these, 35.5% (11/31) diseases were caused by bacteria followed by 29% (9/31), 22.6% (7/31), 3.2% (1/31), 3.2% (1/31) and 6.5% (2/31) were caused by parasites, viruses, protozoa, metabolic and others respectively. Among the examined and treated animals, 26 (83.9%) were recovered, 1(3.2%) died and postmortem examination was conducted on 4 (12.9%) animals. From 26 diagnosed animals with EDDIE App, 16 (61.5%) were similar with laboratory confirmation but 10 (38.5%) were not agreed, and the App was found good. Generally, this study showed that most animal diseases are curable, if prompt and rational drug use with good management can be practiced. Based on this finding, practicing veterinary extension program and training of animal health workers and farmers regularly, including poultry and pet animal diseases with relevant epidemiological data and further evaluation in smartphone App, and establishing advanced diagnostic facilities were recommended to reduce diseases and their associated losses.

**Key words:** *Bishoftu and Modjo, clinical cases, case description, case report, EDDIE App*

## 1. INTRODUCTION

Livestock production comprises an integral component of most countries crucial and largely subsistence economy. It is one of the principal means of achieving improved living standards in many developing world regions. Livestock plays a crucial role in Sub-Saharan African countries for both the livelihood of rural communities and national economies. It provides drought power, milk, and meat, skin and hide, input for crop production and soil fertility, cash income and raw material for industries (Behnke, 2011; Montepellier, 2016).

Ethiopia has naturally endowed with different agro-ecological zones and suitable environmental conditions, making it a home for many livestock species and suitable for livestock production. It is believed to have the largest livestock population in Africa with approximately 58 million cattle, 54 million goats and sheep, plus a collection of horses, donkeys, camels and chickens (CSA, 2016; Tilahun and Schmidt 2012). Thus, this livestock production subsector in this country provides enormous contributions to the national economy and livelihoods of most people. It gives about 16.5% of the national gross domestic product (GDP) and 35.6% of the agricultural GDP. It also provides 30% of agricultural employment and 15% of export income. The livestock subsector currently supports and sustains livelihoods for 80% of all rural population (Leta and Mesele, 2014; ICPALD, 2009).

However, high livestock population and existing favorable environmental conditions are available in Ethiopia, the current output of livestock in the country is little. This can be associated due to a number of complex and inter-related factors such as inadequate feed and nutrition, high prevalence of livestock diseases, the poor genetic potential of local breeds, market problem, inefficiency of livestock development services with respect to extension, credit, marketing, and infrastructure (Jabbar *et al.*, 2007; Negassa *et al.* 2011). Among those hampering factors, animal diseases are considered one of the major bottlenecks of livestock productivity in Ethiopia, posing significant threats to public and animal health and economic stability. Livestock morbidity and mortality due to diseases in Ethiopia are extremely high every year (Shankar *et al.*, 2012; Perry and Grace, 2009; LDM, 2019).

Diseases affecting animals can be infectious or non-infectious depending on their causal agents. The disease causing agents like viruses, protozoa, parasites, bacteria, and fungi are principal agents among infectious while non-agent caused diseases are non-infectious (Badruzzaman *et al.*, 2014; Jana and Ghosh, 2013). Infectious animal diseases that are endemic, or common in Ethiopia, create a variety

of significant adverse economic consequences; most directly by mortality, morbidity, trade restriction, and miscarriage in production and reproduction of animals, and costly treatments and altered management practices to ameliorate these losses also reduce profitability (Bennett and Ijpelaar, 2005; Prod *et al.*, 2016).

Comprehensive and correct disease diagnosis and reporting is a precondition for detecting disease outbreaks in a herd or individual animals and implementing appropriate measures for their control strategies. Improving animal health requires sufficient disease reporting to allow suitable action to be taken to alleviate potential risks rapidly and successfully. Judicious and accurate diagnosing of animals at animal health centers on time is critical to support continuous control and prevention of diseases affecting them and further helps in the detection of outbreaks of different diseases. More evidence is required to describe the pattern of occurrence of clinical diseases for the provision of appropriate veterinary care and an effective disease control strategy (OIE, 2018; FAO, 2018).

Ethiopia is one of the countries with large livestock population with suitable conditions but currently, the out put from the livestock sub-sector is less. This can be due to extensive prevalence of animal diseases with poor animal health service that has been compromised by inadequate and poorly maintained infrastructure and scarcity of professionals (Jibat *et al.*, 2015). The approach taken to this animal health service at different animal health centers is based on a tentative diagnosis that lacks accuracy in diagnosing the disease due to a lack of organized laboratory facilities and financial constraints (Beyene *et al.*, 2018; Eshetu, 2021). The effect of the diseases is exacerbated by lack of access to organized veterinary services and advice, and consequently, the mis-diagnosis and incorrect treatment of endemic diseases. To mitigate this problem, the Ethiopian biotechnology institute has launched a project called improving livestock disease diagnosis, treatment and surveillance system in Ethiopia and revealed Ethiopia differential diagnosis and information environment (EDDIE) smartphone-based mobile application as a diagnostic and treatment aid tool. To use this application as a diagnostic and treatment aid, evaluating its accuracy for disease diagnosis and treatment is needed. Therefore, the objectives of this research were;

### General objective

- To handle and organize case reports on selected clinical cases of major diseases of livestock presented to animal health facilities of VTH of AAU at CVMA, Bishoftu and Modjo Veterinary Clinic, Modjo in and around Bishoftu and Modjo Towns.

### Specific objectives

- To illustrate clinical indicators, diagnosis, differential diagnosis, treatment outcome, prognosis, and control and prevention of each clinical case.
- To evaluate the accuracy of smart-phone-based application as diagnostic and treatment aid tool for different animal diseases.
- To confirm the underlying causes for each disease and forward appropriate recommendations.
- To explore and compile major livestock and companion animal diseases at the study areas.

## **2. STUDY METHODS AND MATERIALS**

### **2.1. Study Area**

This study was carried out from November 2020 to June 2021 on the common diseases of domesticated animals in and around Bishoftu and Modjo towns, Ethiopia that were presented to the veterinary teaching hospital (VTH) of Addis Ababa University (AAU) at the college of veterinary medicine and agriculture (CVMA), Bishoftu and Modjo Veterinary Clinic (MVC), Modjo animal health investigation, diagnostic and treatment facility centers. Bishoftu and Modjo are located 46 and 72 kms at south east of Addis Ababa, the capital of Ethiopia. They are situated at the latitude of about 9° and 8.3° north and longitude of 39.11° and 38.95 ° east respectively. These cities lay at an altitude of 1850 and 1774 meters above sea level in the central high land of Ethiopia respectively. The study areas have three distinct seasons, namely main rain, short rain and dry seasons. Based on weather data, the mean annual rainfall of these areas is 866 and 776 mm with mean minimum and maximum temperatures of 14 °C and 26 °C and 19.4 C° and 59.9% respectively, with a mean relative humidity of 61.3% and 30% respectively. Bishoftu and Modjo towns have variable and yet representative agro-ecologies of the country and farmers in the surrounding areas use a mixed crop and livestock farming system (NMSA, 2006; CSA, 2005).

### **2.2. Study Design and Population**

A descriptive case study and purposive sampling techniques were used on animals presented to the animal health investigation and diagnostic facilities of Addis Ababa University, college of veterinary medicine and agriculture at VTH, Bishoftu and Modjo veterinary clinic, Modjo. Most of the handled cases were brought from Bishoftu and Modjo towns and their surrounding peasant associations as a target for this study. Different species of animals (bovine, equine, ovine, caprine, poultry and pets) with different age groups, sex, and breed types were included in this study. This case study was undertaken at animal health facility centers in and around Bishoftu and Modjo towns, Ethiopia, to report on major and commonly occurring clinical diseases and abnormalities in animals during the study period from November 2020 to June 2021 with a detailed description of case history, physiological parameters, clinical symptoms, tentative, differential and laboratory diagnosis.

Then the cases were treated and thoroughly monitored until recovered either in the VTH and clinic during the consecutive therapies or at home for the diseases with lengthy retrieval. Finally, each case was compiled using case report compiling format that comprises abstract, introduction, description of the case, laboratory investigation and its findings, case management and treatment outcome and discussion for each case which was supported with picture of the corresponding animals during presentation and after recovery that were treated and managed with medical, supportive and surgical therapies.

### **2.3. Case Handling Protocols**

Addis Ababa University's veterinary clinical case recording format and Jana and Ghosh, (2013) clinical case handling protocols were used in this case study as indicated in Annex 1 and Annex 2 respectively.

#### *2.3.1. History taking and examination of animals*

In veterinary medicine disease problems are always presented to the clinician through the owner's complaint, which is a demand for professional assistance. The owner is the best link between clinician and patient animals to provide relevant evidence regarding the case, so appropriate case history is crucial in disease diagnosis. For completeness and correctness of evidence obtained, the following points should be well considered; patient information, present and past history, environment and management history and history of each case were carefully taken, which gave a guideline for examining of the animals (Tamirat, 2019; Duguma, 2016).

Physical condition, behavior, posture, gait, superficial skin wound, prolapsed of different organs, salivation, different discharges, distension of the abdomen and disturbance of locomotion were observed by visual inspection of the patient. Examination of different parts and systems of the body of each of the diseased animals were examined by using physical examination methods (inspection, palpation, percussion and auscultation), needle perforation and movement of the animals. The pulse/heart and respiratory rate and body temperature from each of the diseased animals were recorded. Clinical examinations of all animals of different ages were conducted on the basis of diseases history, owner complaint and symptoms to diagnose diseases and disorders of the animals (Nidra *et al.*, 2018; Jana and Ghosh, 2013).

### *2.3.2. EDDIE Smart phone based application disease diagnosis*

In addition to clinical examination, Ethiopian differential diagnosis and information environment (EDDIE) software was used as a smart phone application diagnostic and treatment aid tool in this research. Different data regarding species of animals (except pet and poultry), clinical signs, diseases rank and treatment options of each disease were recorded on EDDIE. Based on the data recorded by the mobile app (EDDIE), the diagnosis of the disease, the rank of differential diagnosis list, and its treatment were made. In the end, expert's or veterinarian's tentative disease diagnoses were compared with the smartphone-based mobile application (App) diagnosis. The appropriate samples were collected from the individual cases which were tentatively diagnosed by a clinician and the App from the study sites, and were transported to Addis Ababa University at CVMA laboratories (Bishoftu) and national animal health and investigation center (NAHDIC), Sebeta. From this result, the accuracy of the smart- phone-based mobile App in disease diagnosis and treatment was evaluated and compared with the gold standard laboratory findings of the disease and used to confirm the underlying causes of each illness.

### *2.3.3. Laboratory investigation*

Appropriate and representative samples were collected from tentatively diagnosed individual animals from the study sites and transported to AAU-CVMA laboratories (biomedical, microbiological, parasitological, clinical pathology and VTH multipurpose) and national animal health diagnostic and investigation center for confirmation.

### 3. COMPILED CASES

#### 3.1. Case Reports on Bacterial Diseases of Livestock

##### 3.1.1. Caseous Lymphadenitis; a case of a sheep and its management

###### Abstract

Caseous lymphadenitis (CLA) is a contagious and chronic bacterial disease of animals that affects the lymphatic system with abscesses. This case report describes the case of caseous lymphadenitis in a sheep that was presented to VTH of AAU-CVMA, Bishoftu on March 06/2021 with a primary complaint of weakness, anorexia and slightly fluctuating sickle shaped and enlarged swelling between the ear and jaws around the neck region developed due to laceration by a wire on the fence. Physical and clinical examination revealed increased body temperature (40.7 °c) and respiratory rate (44 breaths/min) and mildly fluctuating swelling on lymph nodes. Anorexia, coughing, general ill thrift, exercise-intolerant, enlargement of subcutaneous tissues and lymph nodes around the neck region were observed. Aspiration of the swelling revealed thick, pale greenish-cheesy pus. The EDDIE App-based diagnosis and bacterial culture of the pus revealed the case as caseous lymphadenitis. It was managed by surgical removal of the pus and topical and systemic administration of wound spray and penicillin G procaine, respectively. The sheep has recovered after a month. In conclusion, CLA is a challenging suppurative disease of sheep and goats that can be controlled and prevented by isolation of clinically sick animals, proper handling of animals and vaccination of the flocks.

**Keywords;** *Abscess, Caseous lymphadenitis, Corynebacterium pseudotuberculosis, Sheep*

###### Introduction

Caseous lymphadenitis (CLA) or cheesy gland disease which is caused by *Corynebacterium pseudotuberculosis*, is a significant and chronic contagious disease that potentially threaten the majority of sheep-rearing countries. This disease is characterized by the formation of widespread abscesses in lymph nodes, subcutaneous tissues and internal organs and reproductive disorders (orchitis, abortion and stillbirth). It occurs worldwide and is considered one of the most economically important diseases, particularly in the sheep and goat industry. That is why it's so-called the plague of small ruminant producers (Pépin and Paton, 2010; Umer *et al.*, 2017).

CLA is caused by *Corynebacterium pseudotuberculosis* (*C. pseudotuberculosis*) which is gram-positive, pleomorphic, rod-shaped, non-sporulating, non-capsulated, non-motile, intracellular, facultative anaerobic bacterium in the family Corynebacteriaceae. This micro-organism also causes other diseases; external subcutaneous abscesses, ulcerative lymphangitis and internal infection in horses (Çetinkaya *et al.*, 2002). Transmission occurs mainly through contamination of superficial wounds by contact, during common procedures (shearing, castration and ear tagging), through contaminated environment (*C. pseudotuberculosis* is able to penetrate skin lesions and oral mucosal injuries), through injuries by other traumatic events and aerosols from animals with lymphadenitis in the lung (Moura *et al.*, 2020; Osman *et al.*, 2018).

The clinical signs of CLA in small ruminants are characterized mainly by weight loss, poor growth, purulent nasal discharge, fever, general ill thrift, abscesses of peripheral and/or internal lymph nodes and organs (lungs, kidneys, liver and spleen), bacteria-induced caseation necrosis of the lymph glands, signs of respiratory disease (cough, dyspnea and tachypnea) (Ribeiro *et al.*, 2013; Constable *et al.*, 2017). The diagnosis of this disease can be mainly based on history of wound, clinical signs, isolation of the agent from discharging abscesses, serology, PCR and ultrasonography or radiography for internal organs. The differential diagnosis of CLA are localized tumour, abscess, hernia, oedema and haematoma (Dercksen *et al.*, 2010; Nassar *et al.*, 2016).

CLA due to *C. pseudotuberculosis* can be treated with penicillin, tetracyclines and cephalosporins. However, treatment with these drugs alone is generally not effective as a result of several factors including the protective nature of the capsule, the formation of the encapsulated abscess as well as the intercellularity of the organism. Therefore, surgical lancing or removing superficially located abscesses along with the above antibiotics is the effective way of treatment (Alves *et al.*, 2020; Constable *et al.*, 2017).

Due to rapid spread of the disease, once introduced into a flock and those infected individuals serve as a reservoir of infection, the control and eradication of CLA is difficult. Generally, it is agreed that the finest strategic way to control the disease is vaccination of healthy animals, along with identification and isolation/ quarantine of infected ones. The disease is highly prevalent and economically important in most sheep producing countries like Ethiopia. It produces a negative influence on the growth, wool, meat and milk production, skin and carcass condemnation and reproductive efficiencies of flocks of small ruminants in which the most efficient strategy for the control and prevention remains in a matter

of debate (Osman *et al.*, 2018; Fikre and Abraha, 2014; Yitagesu *et al.*, 2020). Therefore, the current case report describes the case of caseous lymphadenitis (CLA) and its management in a young sheep.

#### Description of the case

A young sheep with body weight of 20 kg was presented to VTH of AAU-CVMA, Bishoftu on March 06/2021 with the primary complaint of anorexia, weakness, weight loss and hot, slightly fluctuating, sickle shaped and enlarged swelling between the ear and jaws around the neck region. The owner has also stated that the swollen mass has developed due to laceration by a wire on the fence when the sheep was managed under a semi intensive system with other animals. Physical examination revealed that the sheep has body temperature of 40.7 °c, respiratory rate of 44 breaths/minute, heart rate of 88 beats/minute and hot and thick (mildly fluctuating) swelling externally between parotid and mandibular lymph nodes while internally that may be due to retropharyngeal and other associated lymph nodes was felt upon palpation.

Clinical examination has also shown loss of appetite, coughing, general ill thrift, purulent nasal discharge, fever, increased respiratory rates, exercise-intolerant, enlargement of subcutaneous tissues and lymph nodes around the neck region and hot, fluctuating, sickle shaped and enlarged swelling (figure 1) in which aspiration of this swollen mass with a sterile 20 gauge needle with syringe revealed thick, pale green watery to cheesy pus that proved out the swelling as pus-filled cyst around the neck region. The EDDIE App-based diagnosis revealed the case as caseous lymphadenitis. Therefore, based on history of wound, characteristic clinical signs and EDDIE App-based diagnosis result, the case was tentatively diagnosed as caseous lymphadenitis which is differentially diagnosed with localized tumor (lymphoma), abscess oedema and haematoma.

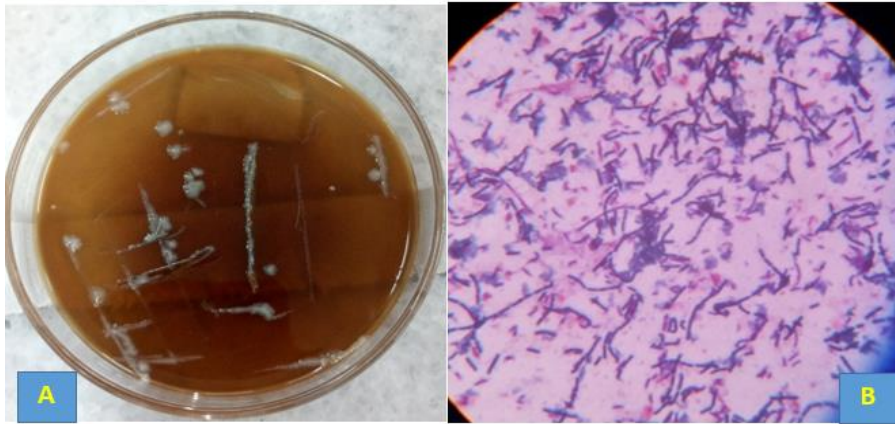


**Figure 1:** Picture of the sheep affected by caseous lymphadenitis (A) and after therapy (B).

#### Laboratory investigation and its findings

A fresh sample was collected from the swollen mass with a sterile needle with syringe and placed into a screw capped bottle containing 3ml of tryptone soya broth and immediately transported to AAU-CVMA, Bishoftu and enriched overnight by placing it inside the microbial incubator at 37°C. The next day, some of the enriched samples were inoculated on a blood agar base supplemented with 7% sheep blood and incubated at 37 °c for 48 hours. After these hours, the sparse growth of small, white to grayish (cream-like) and waxy colonies surrounded by a weak zone of hemolysis (figure 2A) characteristic to *Corynebacterium pseudotuberculosis*, the etiologic agent of caseous lymphadenitis was observed.

From the grown colonies on blood agar, a loop full of the pure colony was taken and a smear was made for gram staining, which provides small, short, gram-positive, pleomorphic (angular, palisade arrangement), looking like rod-shaped (figure 2B below) were observed. Generally, the history of the wound due to laceration, clinical signs, EDDIE App-based diagnosis and laboratory results showed to conclude that the disease affecting the sheep was finally confirmed as caseous lymphadenitis.



**Figure 2:** Laboratory results of caseous lymphadenitis suspected sheep (**A**, indicates the growth of *C. pseudotuberculosis* on blood agar while **B**, showed result of gram stain of colonies from blood agar).

#### Case management and treatment outcome

After confirmation of the disease affecting the sheep as caseous lymphadenitis, the management and treatment approaches used were surgical draining of the abscess by the following procedures; the hair around the swollen area was clipped and shaved, followed by cleaning with clean water and savlone, then lidocaine HCL 2% was locally infiltrated around the swelling to avoid pain during manipulation. Then the abscess has surgically lanced out and flushed with diluted iodine solution followed by applying fortified procaine penicillin into the cavity where the pus content has removed and external chlortetracycline (cyclo) spray (Farvet Laboratories B.V., Netherlands) was also applied.

Finally, intramuscular injection of fortified procaine penicillin (North China pharmaceutical Co., Ltd., Shijiazhuang China) at the recommended dose of 22, 000 IUs/ kg body weight for five days stat was used. Because of the contagious nature of the disease, all materials used to treat this animal were appropriately disinfected and the drained purulent material was also carefully collected and disposed of by burning. The owner was advised to isolate this sheep from other animals by cleaning and disinfecting its bedding until the lesion stops draining and heals. Finally, the sheep has recovered from this disease after a month and sold to some body as the owner reported.

#### Discussion

Caseous lymphadenitis (CLA) is a transmissible, chronically insidious and serious disease of small ruminants caused by intracellular bacterium called *C. pseudotuberculosis*, which enters the body of susceptible animal through superficial wounds, mucous membranes or on direct contact with

contaminated fomites. Then, it follows the lymphatic system and migrates to the regional lymph nodes where they can disseminate to other lymph nodes and internal organs through the lymphatics or vasculature where it forms abscesses in lymph nodes (Osman 2018). All strains produce phospholipase D (exotoxin), which enhances the spreading of the bacteria by destructing endothelial cells and increasing vascular permeability and external lipid coat (virulence factor) provides protection from hydrolytic enzymes in host phagocytes. Bacterial replication occurs in the phagocytes which then rupture, release and ongoing multiplication, followed by attraction and subsequent death of inflammatory cells and forms the characteristic abscesses associated with CLA. Necrosis and capsule formation stages of the abscess due to CLA indicates onion like appearance on cross-section of involved lymph nodes (Galvão *et al.*, 2017; Abd *et al.*, 2020; Jeber *et al.*, 2016).

CLA can occur as an outbreak in a population of small ruminants' farms involving flocks or as a single case (Colom-Cadena *et al.*, 2014) like the infection of the sheep in the present case report that affects one sheep from four. It is not a notifiable disease in many countries, since the actual prevalence in small ruminants is usually underestimated and animal owners are not aware of its economic impacts. The morbidity rate can usually range up to 15%, and morbid animals will often eventually succumb to the disease. Correspondingly, a number of studies that were carried out in different parts of Ethiopia have shown that CLA is a widespread disease, especially in sheep (Fikre and Abraha, 2014; Abebe and Sisay, 2015; Yitagesu *et al.*, 2020).

The hallmark clinical finding in cases of CLA is the development of external abscess in the location of marginal lymph nodes. Common sites of development include; behind the ears, beneath the jaw or neck, on the shoulders, or in the rear flank region and the involved lymph nodes that include parotid, submandibular, prescapular and prefemoral nodes. Caseous lymphadenitis abscesses are characteristically thick walled. Soft pasty white to green exudate filled these abscesses when they are fresh, but typical onion like appearance of rings of thick dry pus is displayed in older abscesses (Constable *et al.*, 2017). Other clinical signs which include; loss of appetite, coughing, general ill thrift, purulent nasal discharge, fever, increased respiratory rate and exercise-intolerant can also be displayed in addition to enlargement of the lymph nodes and subcutaneous tissue that contain pus (Kumar *et al.*, 2017; Abba *et al.*, 2017; Osman *et al.*, 2015). This agrees with the clinical signs of the current case report.

A presumptive diagnosis of caseous lymphadenitis is based on history of the case, clinical examination of enlarged lymph nodes and the characteristic greenish-yellow exudates, culture and identification of the etiological agent (*C. pseudotuberculosis*) from lesions and serological tests by ELISA (Ribeiro *et al.*, 2013; Nassar *et al.*, 2016). The best approach in the management and treatment of CLA is surgical lancing and draining of the pus from the enlarged lymph nodes and subcutaneous tissues and lavage with dilute iodine solution followed by use of antibiotics topically and parentally. In addition to proper management of the case, strict biosecurity measures, elimination of diseased animals from the flock, vaccination, disinfection of shearing materials used for production procedures, removal of hazards in the environment that injure the skin can prevent and reduce the disease (Colom-Cadena *et al.*, 2014; Abba *et al.*, 2017). Thus, the diagnostic, management for removal of the pus along with antibiotic therapy for inhibition of secondary complication and the methods used for the control and prevention of CLA in the current case report were in line with the approaches of the above authors.

In conclusion, CLA is a chronic and challenging suppurative disease of sheep that has severe economic consequences. Thus, control and prevention should focus on the spread of the disease such as isolation of clinically sick animals, vaccination of flocks and proper animal handling technique so as to prevent traumatic lesions to avoid abscess.

### *3.1.2. Colibacillosis (Calf scour); a case of exotic breed calves and its treatment outcome*

#### Abstract

Colibacillosis is one of the most economically important infectious diseases of new borne animals that occur worldwide and cause mortality due to severe diarrhea. A one-week-old male and two-weeks-old female exotic breed calves were presented to Modjo veterinary clinic, Modjo and VTH of AAU-CVMA, Bishoftu, on February 10 and 19/2021, respectively, with primary complaints of smelling gray to yellowish-watery diarrhoea for the past 2-3 days before presentation, lethargy and reduced condition in both cases. The calves were dull and depressed, diarrheic, anorexic, febrile, dehydrated, prostrated with bilateral mildly sunken and congested eyes. One other calf had recently died of recurring similar symptoms in the same herd from the owner who brought the calf in Modjo. The EDDIE App diagnosis and bacteriological laboratory analysis of fecal samples revealed the case as colibacillosis. Sulfamonomethoxine sodium and flunixin meglumine injections aggressively, and ringer's lactate with glucose were used. The calves have recovered after the end of treatment. Prompt antibiotic and

supportive therapies, proper practice of biosecurity, appropriate immunization, and hygienic measures can reduce and prevent the occurrence of clinical colibacillosis.

**Keywords;** *Calf, Colibacillosis, Diarrhea, E. coli*

## Introduction

Colibacillosis (calf scour) is one of the most economically important bacterial diseases of new borne animals characterized by causing prostration and marked profuse watery diarrhoea that can develop to post-septicemic infection which is often non-responsive to treatment (Luppi, 2018). The disease has become the leading cause of early deaths in calves resulting in severe economic losses in new born animal production. It occurs worldwide and is common in farm animals under three days of age. Still it may occur as early as 12-18 hours after birth and occasionally appears in calves up to several days of age when there is mixed infection with viral pathogens. There is high mortality in calves (10-50%) and piglets among new borns (Lien *et al.*, 2014; Assefa, 2019; Gruenberg, 2014).

The disease is caused by an enterotoxigenic *Escherichia coli* (ETEC) bacteria in the family Enterobacteriaceae; gram-negative, rod-shaped, non-spore forming, and facultative anaerobic, motile/peritrichous flagellated. *E. coli* is the most leading normal flora in the intestinal tract but some types of *E. coli* are pathogenic and cause infections like septicemia, watery diarrhea (enterotoxigenic *E. coli*), when it possess specific virulence factors that enable them to adhere to and penetrate mucosal surfaces of GIT (Quinn *et al.*, 2016). The pathogenic *E. coli* are divided into enteropathogenic *E. coli* and uropathogenic *E. coli*. The groups of *E. coli* bacteria that have been associated with diarrhea in calves include ETEC, enteropathogenic and enterohemorrhagic (Starr, 2014; Sobhy *et al.*, 2020).

Transmission is most often by oral-faecal route through ingestion of contaminated feed and water, however calves obtain the organism from contaminated bedding and calf pens, diarrheic calves, mastitic milk (coliform mastitis) and from the skin of the perineum and udder of the cow and from the animal attendant. Inadequate intake and absorption of colostrum and antibodies is the main reason for susceptibility and development of diarrhea in calves has also been associated with the presence of viral scour pathogens like rotavirus and coronavirus (Mohammed *et al.*, 2019; Constable *et al.*, 2017).

The disease appears as acute, per acute or chronic form and the common clinical findings are marked diarrhea, prostration and death within 12 hours (peracute case), depression, inappetence, stiffness,

sunken eyes and tucked up abdomen, rough hair coat, elevation body of temperature and rapid pulse and respiratory rate, fetid odour profuse yellowish brown to greyish white diarrhea with rapid peristalsis, soiling of the anal and hindquarter region and rapid dehydration and ultimately death (acute case). In chronic cases calves show joint ill, navel ill and pneumonia (Luppi, 2018).

Necropsy findings in acute cases show edema and haemorrhages of the abomasal folds and the intestinal mucosa will show hemorrhage and wrinkling while chronic cases show suppurative change in the joints and changes may be seen in umbilicus, lungs and kidneys (Kuznetsova *et al.*, 2020). Therefore the diagnosis of neonatal colibacillosis is based on history, clinical and postmortem findings, isolation and identification of the organism (*E. coli*) in bacteriological culture, serology (ELISA) and molecular techniques. Its differential diagnosis includes coccidiosis, GIT parasites, salmonellosis, bovine viral diarrhea, rota and corona viral infections (Singh *et al.*, 2019; Ammar *et al.*, 2019).

The treatment of colibacillosis (Neonatal diarrhea) requires vigorous and combined therapy with antimicrobial, intravenous fluid and electrolyte and non-steroidal anti-inflammatory agents. Different antimicrobials such as oxytetracycline, amoxicillin with clavulanic acid, chloroamphenicol, streptomycin, tetracycline and sulfachloropyridazine are reported to be effective in early treatment of enteric colibacillosis (Rosati, 2017; Constable *et al.*, 2017). Though proper control and preventive measures such as decreasing the degree of exposure to the infectious agent, provide adequate non-specific (colostrums) and specific (vaccination) resistance and optimum animal husbandry practices are the most effective ways to alleviate the spread and huge economic and productivity losses of the disease to young animals industry worldwide (El-Seedy *et al.*, 2016; Megersa *et al.*, 2020). Thus, this case report describes a case of neonatal colibacillosis in calves and its treatment outcome.

## Description of the cases

### *Case 1*

A one-week-old male exotic breed calf with major complaints of frequent and profuse brown to greyish-watery diarrhoea for the past two days before presentation, lethargy and reduced conditions was presented to MVC, Modjo, from kebele 01 on February 10/2021. Physical and clinical examination revealed that the rectal temperature of 39.8 °C, pulse rate of 96 beats/minute, respiratory rate of 48 breaths/minute and the mucous membranes were pale and dry, with capillary refill time of 3 seconds, the skin tent was 3 seconds. The calf was dull and depressed, anorexic, had bilateral sunken and

congested eyes with prostration, evidence of gingivitis, febrile, reduced body condition, with rough hair coat, dehydrated, feces soiled the perineal region of hind legs and watery faecal material with evident haematochezia were observed as indicated in figure 3A. One other calf had recently died of recurring similar symptoms in the same herd as the owner reported.

### *Case 2*

A two weeks old female exotic breed calf was presented to VTH of AAU-CVMA, Bishoftu from babogaya on February 19/2021 with major complains of yellowish-brown watery diarrhoea that began about three days before coming to the VTH, listlessness and loss of interest in sucking followed by depression with loss of appetite and reduced condition. Up on physical and clinical examination, the affected calf showed a body temperature of 38.2 °c, respiratory rate of 44 breaths/minute, pulse rate of 96 beats/minute, pale and dry mucous membranes with capillary refill time of 3 seconds and slow skin tent which was 3 seconds. The calf also showed signs of poor response to external stimuli, foul-smelling yellowish diarrhea (figure 3B), rough hair coat, dehydration with tucked up abdomen, straining, prostration, bilateral sunken and congested eyes. In both cases (case 1 and 2) the EDDIE App-based smart phone diagnosis revealed the case as colibacillosis. Therefore based on history, clinical signs and EDDIE App-based diagnosis, this case was tentatively diagnosed as neonatal colibacillosis. It is differentially diagnosed from coccidiosis, salmonellosis, corona virus and rota virus.

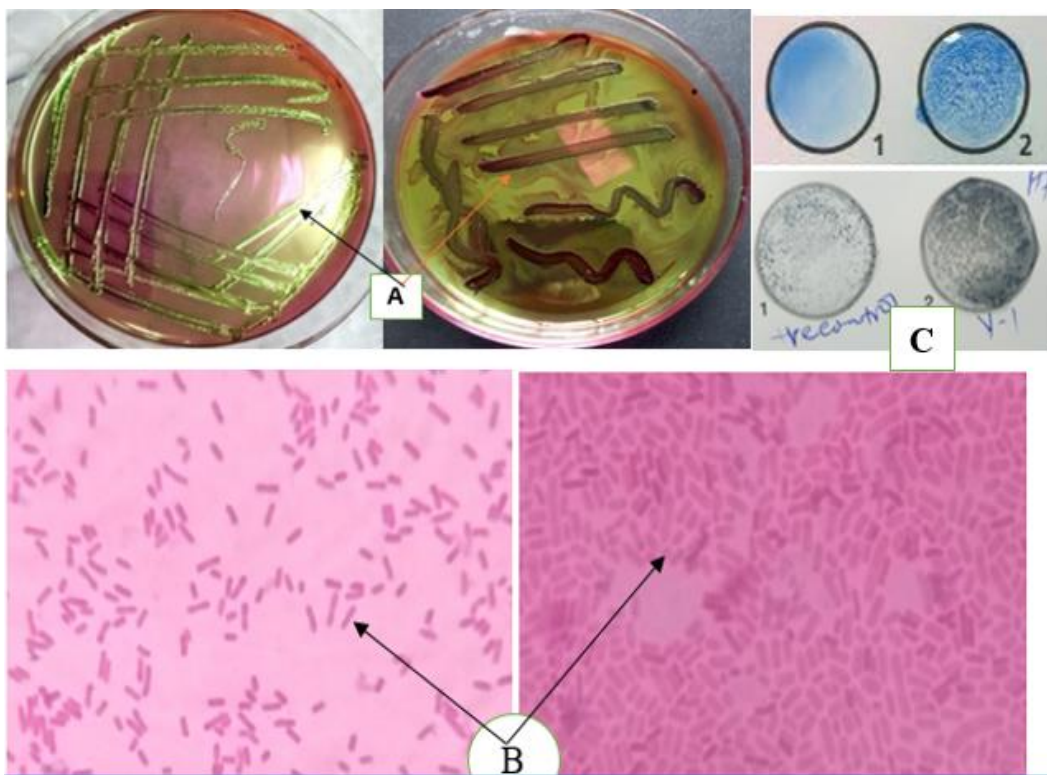


**Figure 3:** Pictures of calves affected by colibacillosis (**A**, indicates male calf with watery diarrhea soiling its perineum and **B**, indicates yellowish-watery diarrhea of female calf).

## Laboratory investigation and its findings

Fecal samples were taken directly from the rectum of the calves and placed on tryptone soya broth in capped screw tube and clean universal bottle for bacterial isolation and parasitic demonstration respectively and immediately transported to veterinary microbiology and parasitology laboratory of AAU-CVMA, Bishoftu. The samples were streaked onto MacConkey agar and incubated at 37 °C overnight. From MacConkey agar plate, lactose-fermenting colonies were inoculated on eosin methylene blue (EMB) agar medium followed by incubation at 37°C for 24 hours, which selectively grows *E. coli* with large, blue-black colonies with green metallic sheen characteristics (figure 4A).

From EMB, pure colony was taken and a smear was prepared for gram staining and the result showed red-stained gram-negative rods (figure 4B). A latex agglutination test for the identification of *E. coli* serogroup O157 was also conducted (figure 4C). Standard biochemical tests were also conducted and indicate catalase, MR-VP and indole positive while oxidase and citrate utilization were negative, TSI indicates yellow alkaline slant and yellow acid but, and no H<sub>2</sub>S production but fermentation of the sugar and reduction of nitrates to nitrites. For parasitological examination, samples were processed by simple floatation technique to detect oocysts and nematode eggs and the result showed negative for these parasitic eggs. Therefore, based on history, clinical signs, EDDIE App, and laboratory results the case was confirmed as colibacillosis affecting the calves.



**Figure 4:** Pictures indicating lab result of colibacillosis suspected calves (**A**, indicates growth of *E. coli* on EMB with left arrow for female and right one for male calf, **B**, indicates gram stain results of corresponding cultured colonies and animals and **C**, latex agglutination).

#### Case management and treatment outcome

The initial medication administered for the treatment and management of this case was by sulfamonomethoxine sodium injection (Chongqing Fangtong Animal Pharmaceutical Co., Ltd., China) with the recommended dose of 0.1ml/kg body weight IV for the course of three days with two doses at first day with an interval of 8 hours after the first injection and one dose daily for the rest days and flunixin meglumine (Zoetis UK limited, London) was also administered with a dose of 1.1mg/kg body weight for two days IM followed by rehydration by lactated ringers solution (Sansheng pharmaceutical P.L.C., Ethiopia) and 40% glucose saline intravenously. The calves were constantly monitored during the time of treatment/ hospitalization. Diarrhea was reduced and stopped in the next and third-day therapy (figure 5), respectively and they resumed to their normal condition like suckling, eating and alertness to move away when approached.



**Figure 5:** Status of the calves after third day therapy.

## Discussion

Colibacillosis is a collection of diseases caused by *E. coli* pathogen which is part of the mammalian and human intestinal microbiota and also widely distributed in the environment that become the most important bacterial cause of diarrhoea in calves during the first few weeks of life. Animals especially, newborn one can get the infection when they become exposed to the pathogen before colostrum was ingested immediately after birth, inadequate or unsuccessful passive immune transfer of antibodies from the dam to newborn, inclement weather, use of milk replacers as opposed to whole milk and poor hygiene especially in calving pens. The disease is known to be one of the leading cause of morbidity and mortality in calves with a consequent reduction of replacement stock that causes major economic threats which affects both dairy and beef cattle production in the livestock industry worldwide (Jesse, 2016; Hailu, 2020; Luppi 2018).

In the current case report, calves aged one and two weeks were infected by this disease indicating an observation of a significant association between the age of the calves and environmental and maternal bacterial (*E. coli*) infection which is in agreement with the findings of (Tadesse, 2020; Megersa *et al.*, 2020) who stated that calves aged between day one to one month, mainly during the first week of their life were at greater risk of diarrhea and this risk decreases as age increases. This association is related to the capability of disease causing agent (*E. coli*) to colonize the sterile offspring gut at early life of neonate after birth and higher susceptibility of newborn calves than adults, especially if they received low amount of colostrum (Constable *et al.*, 2017; Mohammed *et al.*, 2019).

In this case report, the affected calves initially showed typical sign of enteritis with foul-smelling brown to yellowish-watery diarrhea for two and three days, prostration followed by lethargy and depression which were consistent with the signs described by (Constable *et al.*, 2017). The stereotyped clinical signs of enteric colibacillosis including diarrhea with dehydration, weakness accompanied by loss of condition, listlessness and loss of interest for sucking followed by loss of appetite, tucked up abdominal and systemic reactions as well were observed in this case. These clinical manifestations gave a clue for the tentative diagnosis of the disease affecting the calves in which it was later confirmed by isolation and identification of the disease causing agent by bacterial culture and biochemical tests. This finding was in agreement with other findings focused on the causes, clinical symptoms and diagnosis of neonatal diarrhea by (Sobhy *et al.*, 2020; Ammar *et al.*, 2019; Caffarena *et al.*, 2021).

This disease needs an immediate response for treatment, centered on isolation and rehydration therapy by parental antibiotics (Papich and Mark, 2018). The therapeutic management of the current cases was in line with the therapeutic methods recommended by (Rosati, 2017; Pereira *et al.*, 2014) who indicated antimicrobials and replacement by intravenous fluid and electrolytes were recommended for calves with colibacillosis. The recommended control measures against colibacillosis include maintaining hygienic environment to reduce infectious agents, provision of adequate colostrum to the newborn and vaccination of the dam or the new-born calves and optimum animal husbandry practices (Caffarena *et al.*, 2021; Constable *et al.*, 2017). In conclusion, colibacillosis is an infectious disease of newborn animals characterized by foul-smelling dark brown to greyish to yellowish-watery diarrhea with dehydration, listlessness, sunken eyes and tucked up abdomen in which prompt antibiotic and supportive therapies, proper practice of biosecurity, appropriate immunization and hygienic measures can reduce and prevent the incidence of clinical cases.

### *3.1.3. Clinical Mastitis due to Klebsiella (Coliform mastitis); a case of lactating exotic breed cow*

#### Abstract

Mastitis is a potentially fatal mammary gland infection of animals caused by various bacterial pathogens and is responsible for significant economic losses. This case report describes a case of clinical coliform mastitis and its successful treatment in an adult lactating exotic breed cow presented to Modjo Veterinary clinic on February 01/2021 with a major complaint of depression, hot painful swelling of udder and change in the color and consistency of milk and reduced milk production of the left hind

quarter more severely and left front one slightly. Physical and clinical examination revealed depression, decreased milk production, fever, elevated respiratory and pulse rate, and the udder was hot. The left hind and front quarters were swollen and painful to touch up on palpation. The EDDIE App-based diagnosis and laboratory analysis resulted the case as mastitis. The case was diagnosed as coliform clinical mastitis based on clinical signs, change in milk quantity and quality, EDDIE App-based and laboratory result. It was managed and treated with 10% oxytetracycline, dexamethasone and gentamicin through IV, IM and intramammary routes, respectively. Bovine mastitis is one of the most common and widely occurring bacterial diseases of dairy cattle that requires a multimodal approach for treatment and control measures.

**Key words;** *Clinical mastitis, Cow, Klebsiella*

## Introduction

Mastitis, inflammation of the mammary gland and udder tissue is the most widespread and costly disease of dairy cattle occurring globally. It is a multifactorial disease characterized by physical, chemical and usually bacteriological changes in the milk and pathological changes in the glandular tissues and usually occurs as an immune response to bacterial colonization of the teat canal. A wide spectrum of pathogens are involved in the cause and development of bovine mastitis that can be categorized as contagious, an opportunistic and environmental mastitis agents depending on mode of transmission and sources of infection (Seegers *et al.*, 2003; Mbindyo *et al.*, 2020).

Contagious micro-organisms that cause mastitis are true pathogens which usually takes place through haematogenous route without requiring predisposing factors for disease causation and development. These pathogens include Mycobacterium, *Corynebacterium bovis*, Listeria, Bbrucella, Leptospira and Mycoplasma (Bradley *et al.*, 2013). Opportunistic (non-specific) micro-organisms of mastitis are agents that are normally found on the surface of the skin and teat but cause mastitis when the animals are predisposed to different factors. Most common responsible micro-organisms for this type of mastitis are *Staphylococcus* and *Streptococcus* (Quinn *et al.*, 2016; Constable *et al.*, 2017). The third group of micro-organisms are usually associated with coliform bacteria in the environment responsible to cause environmental (coliform) mastitis and it includes *Esherichia coli*, *Klebsiella*, *Enterobacter* and *Citrobacter* species and environmental Streptococci which found in organic matter,

and are the common cause of mastitis in dairy cattle. Coliform bacteria may cause as many as 30-40% of the clinical mastitis cases (Schukken *et al.*, 2012; Cobirka *et al.*, 2020).

*Klebsiella* species which are gram negative bacteria, similar in structure to *Escherichia coli* and commonly found in manure and organic bedding are one of the known causes of principally environment caused coliform mastitis and important opportunistic pathogen of human, mainly affecting immunocompromised or old aged human groups. The most common mastitis-causing species of *Klebsiella* are *Klebsiella pneumoniae* and *Klebsiella oxytoca* which can occur any time during lactation due to immunosuppression and increased stress and dry period due to absence of daily flushing of the gland by milk (Podder *et al.*, 2014; Schukken *et al.*, 2012).

Signs of mastitis can be clinical or subclinical form. The clinical forms of mastitis are characterized by inflammatory changes in the mammary gland tissue (swelling, heat, redness, pain), changes in color, consistency (clot or pus and flakes) and composition of milk, and decreased milk production of the infected quarter, fever, lack of appetite, increased heart rate, reduction in mobility of the affected cow due to the pain of a tremendously swollen udder and hardness of udder due to fibrosis. Clinical mastitis can be peracute, acute, subacute and chronic mastitis. Subclinical mastitis is infection of the mammary gland with non-visible inflammatory changes such as elevated somatic cell count coupled with shedding of causative bacteria through milk and an obviously decreased milk production (Blowey, 2010; Constable *et al.*, 2017; Faw and Pierce, 2013).

The diagnosis of mastitis is based on physical examination of the udder (changes in its shape, size and consistency) and detailed examination of the teat and teat orifices, signs of inflammation (hot, swelling, pain, redness, and loss of function) should be clinically assessed, tests for milk abnormalities, identification and isolation of the organisms from suspected animal's milk (Nickerson and Rayman, 2019; Constable *et al.*, 2017). Treatment of mastitis should aim to eliminate the toxin and use of systemic antibiotics (enrofloxacin, oxytetracycline, ceftiofur, gentamicin, sulfa drugs and others), intra-mammary therapy, corticosteroids (dexamethasone, flunixin meglumine), calcium gluconate and other fluid can provide an effective outcome. For controlling mastitis, cows should be treated during lactation and dry-off, herd monitoring and buying cows from mastitis free farm, isolating infected animals, implementing proper milking procedures, maintaining a clean and dry housing environment, vaccinating animals by coliform mastitis vaccine (J5 bacterin) (Rabie *et al.*, 2019; Mbuk *et al.*, 2016; Sharun *et al.*, 2021).

The economic costs associated with mastitis are numerous to the dairy producer and milk processing industry by causing reduced production, discarding and alteration of milk and increased culling rates, replacement and treatment costs, and public health impacts through horizontal infection caused by consumption of affected milk from mastitic cow that can be affected by pathogens which can be potentially harmful to the public (Azooz *et al.*, 2020). However, dairy industry has recently grown as a very important economic income at the individual farmer, small to large scale dairy farms and national levels, a number of pathogenic micro-organisms causing mastitis are becoming the major constraints to its development by affecting dairy cows directly and influencing milk yield and composition indirectly (Safa *et al.*, 2014; Abera, 2020). Therefore, the current case report describes a case of clinical mastitis caused by klebsiella in an exotic lactating cow and its management.

#### Description of the case

An adult lactating exotic breed cow weighing 320 kg from privately owned small holder dairy farm in Modjo town and managed intensively with other animals was presented to MVC, Modjo on February 01/2021 with major complaint of anorexia, depression, hot painful (sensitive to the touch) swelling of the udder. There was change in the color and consistency of milk and decreased milk production of the left hind quarter more severely and left front one slightly. The cow was milked once a day and was housed in a naturally ventilated free stall barn and fed mixed, chopped dry hay and concentrated feed with other animals and the house was manually cleaned once per two days and the manure was deposited around the farm and used as fuel for cooking indicating not properly removed/ disposed.

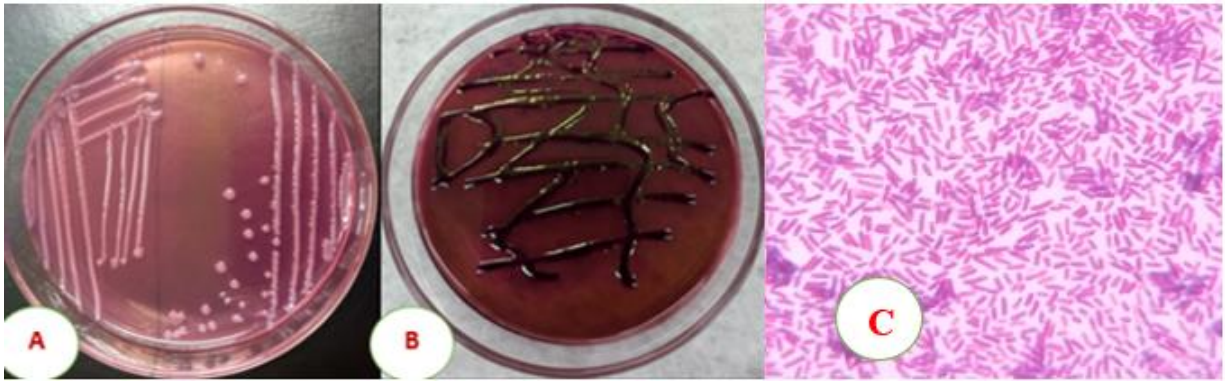
Physical examination revealed body temperature of 39.9 °c, respiratory rate of 26 breaths/minute, pulse rate of 84 beats/minute and the udder was hot with the left hind and front quarters being swollen, hot and painful to touch up on palpation. The clinical examination indicted that the cow showed depression, decreased milk production, increased respiratory and pulse rate, fever, hot painful swelling of udder especially the left hind and front quarter (figure 6B), milk drown from left hind and front quarters was clotted with blood tinged (figure 6A). The EDDIE App-based disease diagnosis resulted the case as mastitis. Based on clinical signs, change in the milk and EDDIE App-based diagnosis, the case was tentatively diagnosed as clinical mastitis.



**Figure 6:** Picture of the cow affected by mastitis with its milk (**A**, indicates clotted milk tinged with blood and **B**, showed swollen left hind and front quarters compared with right one).

#### Laboratory investigation and its findings

Milk samples from the four quarters of the cow were aseptically taken after removal of the first streams of milk and was immediately send to veterinary microbiology laboratory of AAU-CVMA, Bishoftu, for isolation and identification of the etiologic bacteria. Then, this milk sample was inoculated to MacConkey agar, aerobically and incubated at 37 °c for 24 hours and numerous mucoid, brilliant, pink (lactose-positive) grown colonies were observed (figure 7A). Since MacConkey agar grows most Enterobacteria species, further inoculation was done on eosin methylene blue (EMB) agar for isolation and after 24 hours incubation at 37 °c, the grown colonies looks like large, mucoid, pink to purple colonies (figure 7B). From this (EMB), pure colony was taken and smear was prepared for gram staining that showed long gram-negative rods, red to pink in color with single, in pairs, and irregular in arrangement and non-motile organisms (figure 7C). Biochemical tests conducted from the lactose-positive colonies enabled to classify the microorganism as characteristics of *Klebsiella pneumonia* which is the etiology of clinical mastitis in the cow in the current case report. Therefore, based on physical and clinical examination of the udder and teats, changes in the quantity and quality of the milk produced by the corresponding cow, EDDIE App mobile based disease diagnosis and laboratory results, the case was finally confirmed as coliform clinical mastitis.



**Figure 7:** Laboratory result of mastitis affected cow (A, indicates growth of *Klebsiella* spp. on MacConkey agar, B, growth of *Klebsiella* spp. on EMB agar while C, showed gram stain result of the colonies on EMB agar).

#### Case management and treatment outcome

After laboratory confirmation, the case was managed and treated by short acting oxytetracycline injection (KELA N. V. manufacturer, Belgium) at a recommended dose rate of 1ml/10kg body weight once a day for five successive days intravenously, gentamicin sulfate injection 2ml: 80mg (Humanwell Pharmaceutical PLC, Ethiopia) with a dose of 2 ml per teat through intra-mammary infusion every 12 hours per day for three successive days with lidocaine HCl and dexamethasone sodium phosphate injection (Lincoln parenta Ltd, India) at the dose of 1.5ml/50kg body weight was also given intramuscularly for three days once a day additionally. The owner was recommended to isolate this cow from others by placing it in a dry and clean house/bedding and also properly follow hygienic measures to clean the animal house and proper disposal of the manure. After daily checkup and administration of the prescribed drugs through aseptic procedures, the cow has showed progressive improvement on its health and milk yield and complete recovery from the infection was achieved after three weeks.

#### Discussion

The infection of bovine mastitis can be originated from different sources or factors that may include; contaminated milking hands and machine, animal bedding, water and feed, teat trauma and fly vectors, season and stage of lactation and presence of pathogenic micro-organisms in the animal environment. Transmission of these pathogens can occur mainly at bedding, feeding and milking and the most common and worldwide recognized predominant pathogens associated with coliform or environmental

bovine mastitis are *Escherichia coli*, *Klebsiella pneumoniae*, and *Enterobacter aerogenes* that possess lipopolysaccharides, able to produce endotoxins in which mammary glands are extremely susceptible (Constable *et al.*, 2017). Among these pathogenic agents *E. coli* is considered the most common bacteria from environmental origin to cause mastitis (Birhanu *et al.*, 2017; Megersa *et al.*, 2020). *Klebsiella*, commonly found in manure and organic bedding are also pathogenic and one of the principal cause of coliform mastitis and important opportunistic pathogen of human, however, little attention has been given to evaluate the occurrence and severity in the cause of toxemic bovine coliform mammary infections (Massé *et al.*, 2020; Kleinhenz *et al.*, 2019).

The clinical signs manifested by the dairy cow in the current case report were depression, decreased milk production with changes in the quality of milk, increased respiratory and pulse rate, fever, hot painful swelling of udder (left hind and front quarter), clotted and blood tinged drown of milk from these quarters that are in agreement with the clinical form of bovine mastitis which has the greatest frequency and most common chances of occurrence and cause huge economic impacts to the dairy industry as indicated by (Blowey, 2010; WHO, 2014; Almaw *et al.*, 2012) in their different investigations on mastitic animals and its economic analysis.

Studies showed that average incidence of clinical mastitis is around 20-25 cases per 100 cows/year, whereas prevalence of subclinical mastitis among cows ranges from 12.6-30% (Constable *et al.*, 2017), prevalence of clinical and subclinical mastitis and quarter level prevalence for these mastitis were 12.5% and 51.8% at cow level, respectively (Zeryehun and Abera, 2017) and other finding indicates 15% (31/322) and 85% (176/322) were clinical and subclinical respectively, from overall prevalence of 64.3% (207/322), 82.4% mastitis at a cow level were clinical (Zenebe *et al.*, 2014) but in contrary to the above findings, other study indicated that prevalence and occurrence of sub clinical mastitis is more as compared to clinical one (Faw and Pierce, 2013; Ndahetuye *et al.*, 2019).

In the current case report, the diagnosis was made with a through physical and clinical examination of the udder and the teats, physical and bacteriological examination of the milk and by the use of EDDIE App mobile based animal disease diagnosis in which the cow was affected by clinical type of coliform bovine mastitis which was caused by *Klebsiella* bacteria, one of the coliform micro-organisms. This finding agrees with the findings of others that indicated *klebsiella* bacteria like other coliform micro-organisms (*E. coli*, *enterobacter* and others) is one of the most commonly encountered pathogen to cause mastitis (Podder *et al.*, 2014; Ribeiro *et al.*, 2008; Kleinhenz *et al.*, 2019).

The current case was managed and treated by short-acting oxytetracycline, dexamethasone and gentamicine with lidocaine through intravenous, intramuscular and intramammary routes respectively along with recommendation of the owner to isolate this cow from others and to keep hygienic measures. This approach is in line with the treatment protocols of (Constable *et al.*, 2017; Rabie *et al.*, 2019; Kleinhenz *et al.*, 2019; Mbuk *et al.*, 2016). However, some other studies contradict to this treatment protocol that most antibiotics are not efficacious against coliform mastitis because when the bacteria die due to antibiotics, toxins are released and complicate the case so that emphasis should be given to supportive therapy and prevention other than antibiotics (Petersson *et al.*, 2011). In conclusion, bovine mastitis is one of the most commonly and widely occurring bacterial diseases of dairy cattle that requires a multimodal approach for treatment and control measures.

#### *3.1.4. Dermatophilosis (cutaneous streptothricosis); a case of an ox and its treatment outcome*

##### Abstract

Bovine dermatophilosis, caused by *Dermatophilus congolensis* is a superficial skin infection of animals characterized by exudation and matting of hairs and wools with the formation of crusts and scab. An adult local breed ox with a history of reduced appetite, pruritus, dirty scabs and crusts as initial lesion coalesce on its different body parts was presented to MVC, Modjo on December 14/2021. The rectal temperature and other vital parameters were within the normal range. Few ticks were noticed on the skin of the ox assumed as a vector of the disease. The EDDIE App-based diagnosis and culture of the skin scrapings, resulted in the case as dermatophytosis. The case was treated by penstrep and ivermectin parentally and iodine tincture topically. The ox has shown progressive clinical improvement and complete recovery after two months. Dermatophilosis is an economically important skin disease, which is highly prevalent in Ethiopia that needs early detection and treatment in line with proper husbandry practices to control the losses.

**Key words;** *Dermatophilosis, Dermatophilus congolensis, Ox, Skin*

##### Introduction

Dermatophilosis (Cutaneous actinomycosis, Senekobo disease of cattle) is a chronic tick born bacterial skin disease affecting multiple species of animals which is characterized by crustiness and exudates accumulating at the base of the hair or wool fibers. It affects more severely cattle, sheep and goats with

minor zoonosis to the public. This disease occurs throughout the tropical and temperate regions of the world most commonly under low moist (wet weather or rainy season) climatic conditions (Walter *et al.*, 2017). Different factors like dipping, shearing or introducing an infected animal into a herd or flock can increase the spread of infection. Besides its impact on leather quality, it impose economic losses as a result of reduction in body weight gain and milk yield, occasional mortality, reduction of performance in working animals and losses associated with treatment and prevention of the disease (Aliye, 2020; Ndhlovu and Masika, 2016).

The disease is caused by the bacterium *Dermatophilus congolensis* (*D. congolensis*) in the family Dermatophilaceae bacteria which is characterized as a gram positive, spore-forming, non-acid-fast, facultative anaerobic and branching actinomyces. *D. congolensis* has distinct life cycle and exists in two characteristic morphologic forms; branched hyphae and motile zoospores and it requires damage to the skin and invade hair follicles, sweat glands and other epidermal structures for infection (Swanson *et al.*, 2018; Marsella, 2014). It can be transmitted through direct contact or by vectors like ticks, sheep kids and flies and through contaminated instruments. Moisture or cold weather and presence of ectoparasites in association with skin abrasion are predisposing factors to transmit the disease during rainy season (Covarrubias, 2015).

Signs include regional or generalized tufted papules initially, matted hair like paintbrush, pruritus, thick and horny crusts projecting from the skin that vary in color from cream to brown and are 2-5 cm in diameters and keratinized material forming wart-like lesions that can have a wide distribution mainly on the dorsum (withers), face, neck, distal extremities, udder and scrotum (Tresamol *et al.*, 2015). This disease can be diagnosed by history, clinical signs, microscopic examinations of stained exudates or skin scrapings with giemsa and/or gram's stain, cytology, culture on blood agar media (a narrow zone of haemolysis), FAT, ELISA and PCR. It can be differentially diagnosed in cattle from photosensitization, mange mite, warts, lumpy skin disease and dermatophytosis (Jackson *et al.*, 2018; Olaogun and Jeremiah, 2018).

Dermatophilosis can be treated by systemic antimicrobials like penicillin and streptomycin, tetracycline, chloramphenicol and erythromycin with topical adjuvant therapy by lime sulfur, antibacterial shampoo, chlorhexidine, spraying or dipping with copper or zinc sulphate and application of acaricides for the control of vectors has also been considered as rational approach (Constable *et al.*, 2017; Hamid and Musa, 2019). Unlike treating the infected animal, appropriate

control and preventive plans that include change in husbandry practice to keep animals dry, isolating clinically affected animals, controlling ectoparasites and avoiding direct contact to grooming materials play the major role in maintaining livestock health from this contagious disease (Rebhun and DeLahunta, 2019).

Primarily the disease is known by causing the down grading and rejection of the quality of wool, hides and skin and create economic consequences due to a decrease in hides and wool export industry in Ethiopia, in addition with leading of decreased production, reduced fertility and draught performance, treatment, control and preventive costs or losses due to death (Kumar *et al.*, 2018; Hussen, 2020). Therefore, the current case report describes a case of Dermatophilosis in ox and its treatment outcome.

#### Description of the case

An adult local breed ox with the history of a reduced appetite, pruritus, grayish to yellow colored scabs and crusts that cover different body parts was presented to MVC, Modjo on January 14/2021. The physical examination findings revealed that the rectal body temperature (38.9 °c) and the other vital parameters like heart or pulse rate (62 beats/minute), respiratory rate (18 breaths/minute) and capillary refill time were within the normal range with a normal colour of visible mucus membrane and normal palpable lymphnodes. On clinical examination the ox showed moderate degree of pruritus. Other signs that include tufted papules initially, matted hair like paintbrush, thick horny crusts projecting from skin that vary in color from grayish to yellow and keratinized material forming wart-like lesions that were widely distributed mainly on the dorsum (withers), face, neck, distal extremities (limbs) and scrotum as clearly indicated in figure 8A were observed. Few ticks (figure 8B) were noticed on the skin of the ox assumed to be the vector of the disease. The EDDIE App smart phone based animal disease diagnosis resulted the disease as dermatophytosis. Therefore, based on history and clinical signs the case was tentatively diagnosed as bovine dermatophilosis which is differentially diagnosed from mange and dermatophytosis.



**Figure 8:** Picture of dermatophilosis suspected ox (**A**, indicates lesions of the disease in different body parts while **B**, shows tick vector at rectal area).

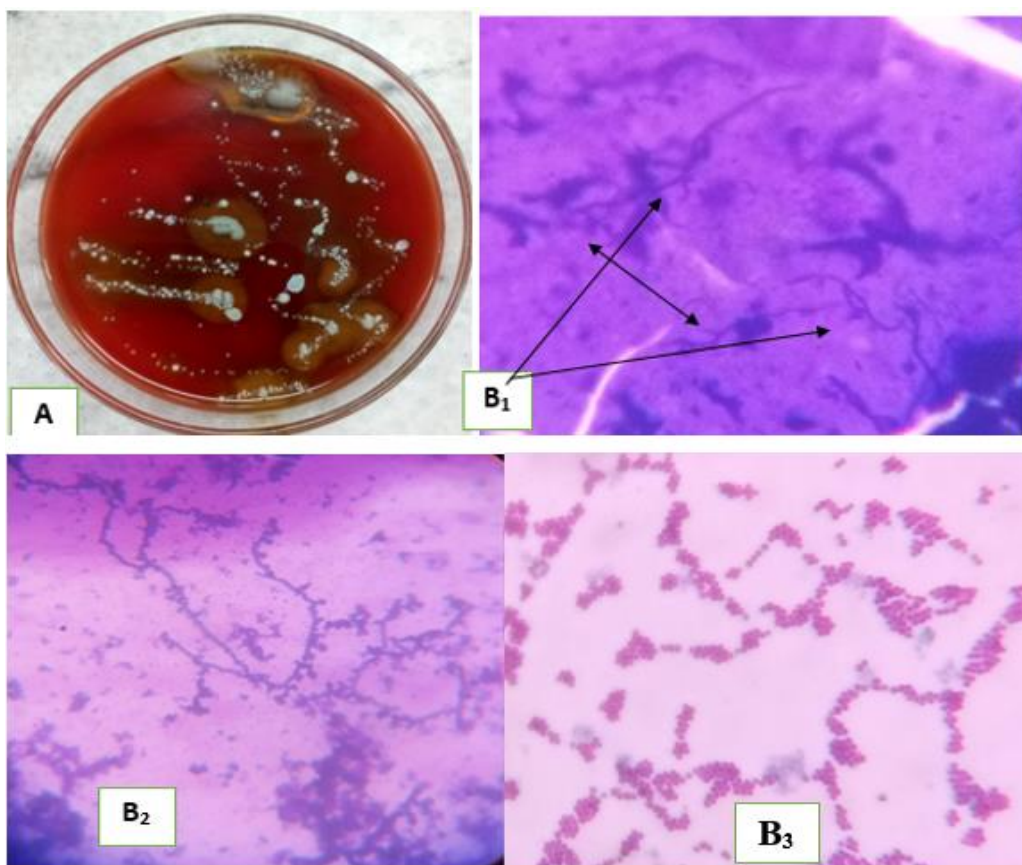
#### Laboratory investigation and its findings

Skin scraping was collected after cleaning the area where the sample was taken and immediately transported to Veterinary microbiology laboratory of Addis Ababa University at CVMA, Bishoftu. Thus fresh scraps were minced on a sterile pestle and mortar with some drops of sterile distilled water. From this crushed sample, some amount of scrap was taken with a wire loop and inoculated to blood agar base supplemented with 8% sheep blood and incubated at 37 °c for 48 hours aerobically showing growth of *D. congolensis* which is small, grayish-white raised granular, mucoid, haemolytic colonies (figure 9A).

Simultaneously, drops of crushed sample was placed on microscope slides and allowed to air dry and then stained with giemsa and gram stain. Then examination of these stained smears under oil immersion (100X) revealed a result of parallel rows of gram-positive branching filament of cocci forms that looks like railroad tracks (tram track like appearance) as clearly indicated from figure 9B<sub>1</sub> and B<sub>2</sub> for giemsa and gram staining respectively. Other gram staining was also conducted from the grown colony on blood agar for comparison and indicates similar result (figure 9B<sub>3</sub>).

The biochemical tests were also conducted and indicate catalase and oxidase positive, indol and voges-proskauer negative and acid production from triple sugar iron. Thus, the above laboratory results indicated the characteristics of *D. congolensis*, the etiology of dermatophilosis. Additionally the skin scrapings were also examined under direct microscopy using 10% KOH to detect presence of fungus

or mites but didn't revealed any mite or fungal infection. Therefore, based on history, clinical signs and laboratory results, the infection of the ox was confirmed as dermatophilosis.



**Figure 9:** Laboratory result of dermatophilosis suspected ox (**A**, indicates growth of *D. congolensis* on blood agar, **B<sub>1</sub>**, indicates tram track like appearance on giemsa stain, **B<sub>2</sub>**, direct gram stain result of skin scrap indicating branched hyphae and **B<sub>3</sub>**, shows gram stain result from blood agar).

#### Case management and treatment outcome

Since dermatophilosis requires a systemic antimicrobial and topical adjuvant therapy along with change in husbandry practice to keep animals dry, the current case was managed by treatment with penstrep (Interchemie werken “De Adelaar” B.V., Holand) with a recommended dose rate of 1ml/20kg body weight for three consecutive days IM and a single dose of ivermectine (Hebei hope harmony pharmaceutical Co., Ltd., China) with the recommended dose of 1ml/50kg body weight SC once a day for infestation of ticks as acaricide. Additionally iodine tincture was also applied topically for four days to hasten recovery along with recommendation of the owner to isolate the animal and keep it in dry place. Following therapy and management of the ox, progression of illness was halted after 4 days

therapy and the animal showed marked improvement and complete clinical recovery was noticed after two months with the gradual disappearance of scabs and crusts as the owner has reported through.

## Discussion

Dermatophilosis is an infectious, highly contagious and economically important skin disease of cattle, sheep and other animals. It is caused by *D. congolensis* which is normal inhabitant of livestock skin and found in water, organic material and environment of livestock farms that can be transmitted by direct contact, arthropod vectors and contaminated materials (Walter *et al.*, 2017; Bayisa *et al.*, 2012). Susceptibility of skin by trauma, effect of prolonged or heavy rain fall, malnutrition and concurrent disease, high humidity and temperature, reduced natural barriers of integument of animals and presence of various ectoparasites are the factors that influence the transmission, prevalence and seasonal incidence of dermatophilosis (Covarrubias, 2015; Kumar, 2020; Ranjith *et al.*, 2018). These authors also stated that the occurrence of the disease varies in different environmental conditions and management systems. It is clearly reported that this disease is highly prevalent in Ethiopia by causing huge economic losses from wool, skin and hide industry and it occurs in warm and humid conditions of tropical areas mainly during rainy season or wet weather conditions (Kebede, 2019; Sarba and Borina, 2017). However, the current case occurred at dry period (mid of January) which can be associated with the presence of tick vectors in the area.

The clinical pictures manifested in clinical dermatophilosis are matting of hair or wool, scab and crust formation and generalized formation of massive crust in chronic cases which leads to hair loss and even local loss of the upper skin layers that predisposes to secondary complications. Additionally, the affected animals may present papular crusted lesions that can be initiated by ticks or biting flies which are primarily distributed on different parts of the body especially on the trunk, head, lower part of the neck, axillae, groin, udder and scrotum suggesting the possible involvement of ticks in the establishment of the disease at the same sites (Siva and Vijaya, 2015; Sarba and Borina, 2017; Constable *et al.*, 2017). This agrees with the current case report that the presence of tick and clinical lesions of dermatophilosis affecting the ox were noted on different body parts and the signs varied from erythema to thick scab formation which coalesces to form cutaneous keratinized wart-like lesions.

Many trials have been published on the treatment of dermatophilosis in cattle of different age groups, however, successful therapy of this disease will give a better outcome when a combination of systemic

antibiotics like tetracyclines, penicillins, streptomycin, chloramphenicol, erythromycin, lincomycin-spectinomycin mixture, ceftiofur, ampicillin and oxytetracycline, and topical application of different preparations were used effectively (Ndhlovu and Masika, 2016; Domingues *et al.*, 2018; Hamid and Musa, 2019). This is in line with the treatment and management action taken for the current case with penstrep which is a combination of penicillin and streptomycin giving a bactericidal effect to the disease causing agent and ivermectin for removal of tick and other vectors as acaricide along with topical application of iodine tincture as adjuvant and antiseptic solution. Thus, the ox showed a better clinical improvement and recovery within short time. In conclusion, bovine dermatophilosis is an economically important tick-associated skin disease of cattle characterized by an exudative, pustular crusting dermatitis and formation of scabs, crusts and loss of hair. Therefore, it needs early detection and treatment along with following proper husbandry practices to control the losses.

### *3.1.5. Bovine salmonellosis; its management and treatment outcome in ox*

#### Abstract

Salmonellosis is the leading cause of bacterial gastroenteritis in animals and humans worldwide and causes high morbidity and mortality of affected animals, and high treatment costs. A previously healthy local breed adult ox was presented to VTH of AAU-CVMA on December 12/2020 with major complaint of weakness, reduced appetite and body condition, watery and smelling diarrhea. The owner also complained that, when the ox reduced taking its usual food, he had tried to change it by providing from other person's animal feed remnant. On physical and clinical examination the ox experienced severe depression, fever (40.6°C) and moderate dehydration with delayed capillary refill time and watery, smelly and profuse diarrhea. The EDDIE App-based smart phone diagnosis revealed the case as colibacillosis. Laboratory findings indicated the characteristics of salmonella bacteria. Based on history, clinical signs and laboratory findings, the case was finally diagnosed as salmonellosis. Injection of sulfadimidine sodium 33.3% and multivitamin IM and IV infusion of lactated ringer's solution were given. The ox has responded well to the treatment and recovered from the disease. Salmonellosis is an infectious disease of animals and humans that needs rapid, specific and sensitive detection methods for appropriate therapy. Applying hygienic practices and scientific-based management strategies can efficiently alleviate the risks associated with it.

**Keywords;** *Ox, salmonellosis, watery diarrhea*

## Introduction

Salmonellosis is an acute or chronic contagious disease of all species of animals and human being which occurs worldwide and characterized by a leading cause of bacterial gastroenteritis. It is one of the major food borne diseases in the world and it is estimated that 93.8 million cases of gastroenteritis occur due to *Salmonella* species globally each year, with 155,000 deaths. The disease has got economic importance as it causes huge losses as a result of heavy mortality and high morbidity, abortion, reduced production and reproduction and high treatment costs mainly in developing countries including Ethiopia. Although salmonellosis in cattle can be caused by many different serovars, *Salmonella dublin* and *S. typhimurium* are the most common serovars associated with disease outbreaks (Pal, 2020; Shanshal, 2019; Yalew, 2020).

Salmonellosis is caused by *Salmonella* bacteria categorized as facultative anaerobic, non-spore forming and non-motile, gram-negative rods within the family Enterobacteriaceae. It is oxidase negative, catalase positive, reduce nitrates to nitrites and can ferment glucose and mannose without producing gas but do not ferment lactose (Carr, 2017; Moxley, 2013). *Salmonella* live in the gastrointestinal tract, often without evidence of clinical disease of many species of animals but also can persist in the environment (Carroll *et al.*, 2016). *Salmonellae* were separated into different “serovars or serotypes” originally according to a scheme of serological classification of H (flagellar) antigens and poly-O (cell wall). Currently, there are 67 O-antigens and 117 H-antigens that have been identified. According to the current CDC system, the genus *Salmonella* consists of two species: *Salmonella enterica* and *Salmonella bongori*. *Salmonella enterica* sub spp. *enterica* is most relevant to animal disease and more than 2,600 serovars have been identified (Ferrari *et al.*, 2019; Carr, 2017).

There are several ways for transmission of salmonellosis and most species of *Salmonella* are spread by direct or indirect means. The source of the organisms are infected animals; they excrete them and infect other animals, directly or indirectly by environmental contamination, primarily water supplies and feed. In addition, fecal-oral route is the other mechanism by which animal to human and inter species transmission of infection will occur (WHO, 2018; Chen *et al.*, 2013; McEntire *et al.*, 2014). The source of infection is usually contaminated environment; pasture contamination is important source of salmonellosis; results when flooding occurs and there are many reports of clinical case in adult cattle arising from grazing recently flooded pasture. The infection can be animal-animal, environment-animal, animal-human, and human-human (Nazareth, 2017; Reddy *et al.*, 2016).

Salmonellosis causes a number of characteristic clinical infections in animals and humans that may depend on the infecting dose, health of the host, serovar/strain, and other factors. Cattle can be chronically infected and serve as carriers within the herd and shed *Salmonella* intermittently (Love *et al.*, 2017). Clinical cases of bovine salmonellosis are usually observed as foul smelling watery, mucoid or bloody diarrhea, fever, depression, anorexia, gastroenteritis, dehydration, enteric fever. In rare cases, the infected cattle may suffer from respiratory disease, undergo an abortion which is associated with high production loss. During acute enteric disease, animals show fever, depression, inappetence, and low milk yield followed by foul-smelling prominent diarrhea, colic and dehydration. Animals suffering from subacute enteric salmonellosis present with similar but less severe signs as the acute syndrome (OIE, 2018; Jajere, 2019).

The diagnosis of salmonellosis is based on history, clinical signs, necropsy findings, confirmation by isolation and identification by culture, ELISA, serum agglutination, and complement fixation. The diagnosis of carrier animals is more difficult because they shed bacteria intermittently, and it may take a number of fecal specimens before a positive culture is obtained (Lee *et al.*, 2015; ISO-6579, 2017; Guizelini *et al.*, 2020). The diarrhea associated with enteric salmonellosis in adult cattle can be bloody or dysenteric and should be differentiated from that induced by other infectious agents such as BVD virus, rift valley fever virus, paratuberculosis, coccidiosis and other helminths, and toxic plants, and colibacillosis (Gal-Mor, 2019).

Salmonellosis can be very fatal, but can be treated with broad-spectrum antibiotics if detected early before loss of the integrity of intestinal mucosa. Some *Salmonella* isolates may be resistant to multiple antibiotics. Parenteral fluid therapy can increase survival rates from acute dehydration and toxemia when administered intravenously. Housing sick animals in a clean, dry, and climate-controlled environment can also improve outcomes. Salmonellosis causes substantial economic losses through mortality, poor growth rate, food poisoning and costs associated with diagnosis, treatment and disease management (Constable *et al.*, 2017; Gal-Mor, 2019).

As a control and preventive measure, animals should not be allowed to drink water from sewage of stagnant pool or pond, sterilize ingredients of animal feed and provide clean drinking water for grazing livestock with clean water and feed troughs. Proper pasteurization and treatment of animal origin food for human consumption. Affected animals should be brought under immediate treatment. Purchase replacements directly from the farm origin and avoid mixing of animals from different sources.

Physically clean the environment and disinfect the premise following resolution of the outbreak. The major drawback in the control and prevention of salmonellosis is the occurrence of clinically normal carriers in all the host species (Gut *et al.*, 2018; ECDPC, 2020). Thus, the present case report describes the case of salmonellosis in ox and its treatment outcome.

#### Description of the case

A previously healthy local breed adult ox with 285 kg body weight was presented to VTH of AAU-CVMA, Bishoftu on December 12/2020 with major complaints of depression, reduced appetite and body condition, watery and foul smelling diarrhea that began a few days before presentation, weakness and dehydration. The owner also complained that, when the ox reduced taking its usual food, he had tried to change it by providing from other person's animal feed remnant as a trial. On physical and clinical examination the ox experienced severe depression, fever (40.6 °c), heart rate of 72 beats/minute, respiratory rate was 28 breaths/minute and moderate dehydration with delayed capillary refill time and watery, fetid odour and profuse diarrhea with blood clots which was the prominent clinical sign as indicated in figure 10 below. The smart phone EDDIE App revealed the case as colibacillosis. Based on history and clinical signs observed, the case was tentatively diagnosed as salmonellosis which is differentially diagnosed from colibacillosis, coccidiosis, toxic plants and campylobacteriosis.

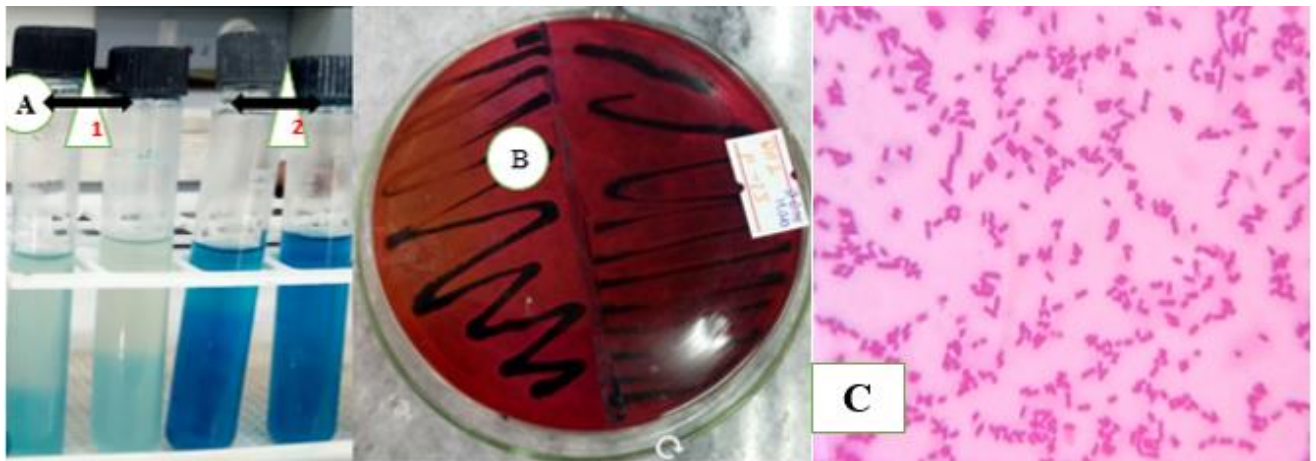


**Figure 10:** Picture of ox suspected by salmonellosis (**A**, watery diarrhea with blood clots at 1<sup>st</sup> day, **B**, on 2<sup>nd</sup> day after therapy).

## Laboratory investigation and its findings

Fecal sample was directly taken from the rectum of the ox and placed in screw capped bottle with buffered peptone water as enrichment medium, and with universal bottle and transported to veterinary microbiology and parasitology laboratory of AAU-CVMA respectively for further confirmation. Fecal floatation technique was performed for the detection of Eimeria/Coccidian oocytes and other nematodes but the result was negative. The sample was enriched for 24 hours at 37 °c then from the enriched media it was cultured on rappaport vassiliadis medium (secondary selective enrichment liquid media) which was incubated at 37 °c for 24 hours, and it gives a clear suspension (turbidity) (figure 11A).

Finally, the sample from rappaport was sub cultured on xylosine lysine deoxycalcate (XLD) media (selective media) which showed a positive result by growing small red and dome shaped colonies, which have central black spot indicating H<sub>2</sub>S production (Figure 11B). Gram staining was conducted from these colonies and red stained small rod-shaped (coco bacillus) gram-negative bacteria were observed as indicated from figure 11C bellow. These colonies were examined biochemically and the results showed catalase and methyl red positive, indole and voges-proskauer negative, sugar fermentation and H<sub>2</sub>S production and citrate utilization (annex 3). Finally, based on history, clinical signs and laboratory results, the case was confirmed as bovine salmonellosis.



**Figure 11:** Laboratory results of salmonellosis from the ox (A, indicates turbidity on rappaport *vassiliadis* medium (1) and negative control (2), B, showed cultured sample on XLD, and C, indicates gram staining result).

## Case management and treatment outcome

The laboratory findings of the current case showed salmonella positive result. Therefore the management and treatment protocol used for this case as the best medical therapy was sulfadimidine sodium 33.3% (Shandong Jinyang Biological Pharmaceutical Co., Ltd, China) at a dose of 1ml/10kg body weight for the first day as initial dose followed by 0.5ml/10kg/day the following days as maintenance dose intramuscularly, 1ml/10kg multivitamin IM and lactated ringers (Aculife healthcare Pvt. Ltd. Gujarat, India) intravenous infusion (figure 12A) were also given. The owner was also recommended to follow the ox in a separate condition from other animals with good management and keeping the hygienic status of animal housing and their feeding. Finally, the ox has showed great improvement by responding well to the treatment and recovered (figure 12B below).



**Figure 12:** Status of the ox during IV fluid substitution (A) and after three weeks post therapy (B).

## Discussion

The infections due to salmonellosis causes significant morbidity and mortality both in animal production and human's health as well as considerable economic losses globally. The major clinical signs observed from the current case were depression, foul smelling watery diarrhea, dehydration, lethargy, loss of body condition and weakness which affects the productivity of the animals. This agrees with the study conducted as clinical case studies and the economic consequences of animal salmonellosis (Kerkeni *et al.*, 2018; Marques *et al.*, 2013).

For laboratory confirmation of the salmonellosis, non-contaminated and fresh fecal samples should be collected and immediately transported to a laboratory for further preservation and analysis (Love *et al.*, 2017). The current case was diagnosed as salmonellosis based on history, clinical signs and laboratory findings. The collected fecal sample from the ox was cultured on XLD media after rappaport vassiliadis enrichment overnight. Then the growth of the organism showed a positive result for salmonella. This agrees with the studies conducted as fecal microbiome analysis of salmonellosis by (Muñoz-Vargas *et al.*, 2018; APHA, 2020; Garrido-Maestu *et al.*, 2019).

In case of salmonellosis infection, where feed is suggested as a point source of the infection, timely and thorough sampling of the suspected animal and feed by a responsible body is therefore of great importance to prove the causal relationship so as to follow very strict hygienic measures to limit transmission to other animals (Reddy *et al.*, 2016; Guizelini and his colleagues, 2020). This finding also agrees with the current case report in which the feed that the owner gave to the ox could be the source of infection and sample was taken from the animal to identify the disease causing-agent.

The treatment protocol followed for this case was injection of sulfadimidine sodium 33.3% with recommended initial and maintenance dose rates intravenously with supportive treatment by multivitamin intramuscularly and IV lactated ringer's solution that provided good response to the disease and it was in agreement with the treatments recommended for salmonellosis infection by (Tamamura *et al.*, 2016; Constable *et al.*, 2017). One of the prominent clinical signs of salmonellosis is profuse watery diarrhea which causes severe dehydration due to fluid and electrolyte loss. Therefore, an intravenous lactated ringer solution for fluid loss was administered. This protocol agrees with the practices stated in the literature indicating rehydration as integral therapy in animals with salmonellosis (Love *et al.*, 2017; Kerkeni *et al.*, 2018; OIE, 2018).

In conclusion, salmonellosis caused by salmonella bacteria is an acute or chronic contagious disease of all species of animals and humans characterized by gastro-enteritis and infected animals may shed the organism in their feces at incubatory stages of the disease. Thus, a rapid, specific and sensitive detection method is important for prompt therapy for an effective outcome. Practicing hygienic measures and applying scientific-based management strategies can efficiently alleviate the risks associated with salmonellosis in animals and humans.

### 3.1.6. Management of *Staphylococcus aureus* caused Abscess; a case of cross breed ox

#### Abstract

Abscess is swelling with an accumulation of pus surrounded by fibrous tissue that may occur anywhere in the body where pyogenic bacteria can establish and multiply. This case report describes the case and successful management and treatment of the abscess from the ventral part of dewlap around the neck region with a history of trauma in a cross breed adult ox that was presented to VTH of AAU-CVMA, Bishoftu on March 20/2021. During physical and clinical examination, vital signs were within normal values, but swelling and pain on palpation were observed at the dewlap. Large pus-filled mass that feels hot and soft in consistency with inflammatory signs was diagnosed. EDDIE App-based diagnosis revealed this case as an abscess. Bacterial culture, gram staining of grown colonies and biochemical test by coagulase revealed the characteristics of *staphylococcus aureus*, one of the principal causes of an abscess. Therefore, based on clinical signs, EDDIE App diagnosis and laboratory result, the case was diagnosed as abscess and differentially diagnosed from haematoma, neoplasms, edema and parasitic diseases. The animal was treated by regular drainage of pus along with daily antiseptic dressing with povidone iodine and parenteral administration of penicillin G procaine for three days. The ox has successfully recovered after two weeks without any other complications. Successful management of skin or subcutaneous abscess in cattle can be achieved by proper drainage of the pus followed by antiseptic gauze packing and parental administration of antibiotics after isolation of the pyogenic bacteria.

**Keywords;** *Abscess, ox, pus, Staphylococcus*

#### Introduction

Abscess, a collection of pus is the most common swelling observed on the skin surface of farm animals' body that hollow out a cavity in the tissues by destroying and expanding them. It can be caused by trauma (puncture, lacerations, penetrations, surgery); necrotic tumor centers, bone sequestra or foreign bodies and systemic infections (Misk *et al.*, 2020). Along these primary causes, invading micro-organisms can access the animal body through a break in the continuity of skin or mucous membrane. Many infectious micro-organisms are characterized by formation of abscess in different body parts either superficial underneath the skin or deep inside tissues and body organs. After a war between the invading pus forming microorganisms and living tissues and cells, pus can be established as end result

by consisting of a dead and living polymorpho nuclear leucocytes, pyogenic microorganisms, cellular debris, serum and lymph (Pressz, *et al.*, 2015; Hassan *et al.*, 2019).

The clinical signs of abscesses at early stages, may show signs of inflammation; pain, heat, swelling, tenderness and loss of use and later become cold and surrounded by a fibrous capsule (Tuffyli and Shekhan, 2012). Diagnosis of abscess can be established depending on case history, clinical signs, and needle puncture and ultrasound examination (to identify extent, depth and ventral aspect of abscess). Abscess can be differentially diagnosed from hernia, hematoma, oedema and fasciolosis in this case report (Misk and Semieka 2016). The main principle of abscess management and treatment is ventral drainage and antibiotic therapy depending on the site, nature and cause of abscess (Papich and Mark, 2018; Sangwan *et al.*, 2017). Thus, the current case report describes a case of abscess and its management and treatment outcome from ox.

#### Description of the case

An adult cross breed ox weighing 300 kg body weight with a history of small wound due to trauma that later developed to a swelling at the ventral part of dewlap around the neck region was presented to VTH of Addis Ababa University at CVMA, Bishoftu on March 20/2021. The ox was anorectic and excited for few days with loss of weight before presentation. During physical and clinical examination vital signs were in the range of normal values (body temperature was 38.1 °C, respiratory rate of 20 breaths/minute, heart rate of 72 beats/minute and the mucus membrane of the ox was pink) but swelling of ventral dewlap with pain on palpation was observed. Large pus filled mass that was feel hot and soft in consistency but painful in touch with inflammatory signs was diagnosed.

Centesis of the swollen mass by inserting sterile 16 gauge needle after injection of lidocaine through a local block anesthesia into the affected area revealed large pus filled cavity that confirmed the swelling as an abscess as indicated in figure 13 below. EDDIE App-based smart phone disease diagnosis revealed this case as abscess. Hence, based on clinical signs, EDDIE App-based disease diagnosis and centesis of the swollen mass by inserting sterile needle, the case was diagnosed as subcutaneous abscess which is differentialyl diagnosed from hematoma, neoplasms, oedema and parasitic diseases in this case report.

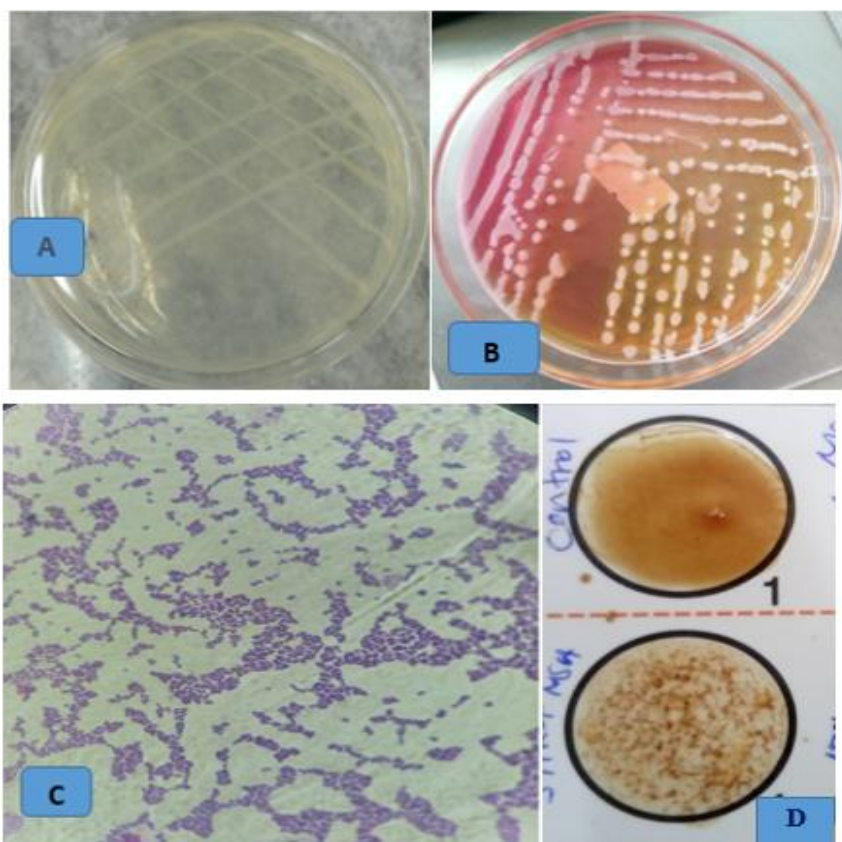


**Figure 13:** Picture of the ox suspected with subcutaneous abscess at the ventral side of dewlap.

#### Laboratory investigation and its findings

After confirming the swelling as abscess by clinical signs, palpation and centesis with sterile needle, small amount of pus was collected directly from the swollen mass and placed in a sterile screw capped bottle and immediately transported to veterinary microbiology laboratory of AAU-CVMA, Bishoftu. Then, this sample was inoculated on nutrient agar and incubated at 37°C for 24 hours and showed the growth of the micro-organism as indicated in figure 14A below. The next day, a loop full of grown colonies from nutrient agar were taken and inoculated to mannitol salt agar (MSA) which is a selective media for staphylococcus and incubated at 37 °c for 24 hours that showed the growth of staphylococcus with characteristic grayish yellow colonies with yellow zones, as indicated in figure 14B below.

From the colonies grown on MSA, gram staining and coagulase test were conducted and the result revealed the observation of blue stained cocci shaped micro-organisms in bunch of grapes and coagulation reaction (figure 14C and D) that specifically indicates *staphylococcus aureus*, one of the principal cause of pus (abscess) and the most commonly isolated pyogenic micro-organism. Therefore, based on clinical signs, EDDIE App-based diagnosis and laboratory result, the case was finally diagnosed as subcutaneous abscess.



**Figure 14:** Laboratory results of the ox from abscess case (A, indicates growth of pus on nutrient agar, B, growth on MSA, C, indicates gram stained result from MSA and D, coagulase result).

#### Case management and treatment outcome

This case was successfully managed and treated by the following protocols; first the animals was properly restrained and the swollen part was shaved and cleaned with water and savlone, after cleaning lidocaine was infiltrated locally to anaesthetize the incision and pus removal site, then a sterile disposable scalpel blade was used to make an incision at the most fluctuant point of the swelling at the ventral aspect of the abscess. After this incision, the pus was evacuated out as a stream (figure 15A) from a swollen mass. Then, after removal of the pus the evacuated cavity was flushed thoroughly with clean and copious amounts of water under moderate pressure from a hose using a gloved finger to gently aid removal of pus. After this, the wound was packed with iodine tincture soaked gauze with regular drainage of the pus along with daily antiseptic dressing for three successive days and IM administration of penicillin G procaine (Hebei Hope Harmony pharmaceutical Co., Ltd., China) with the recommended dose rate of 1ml/15kg (400,000 units/kg) body weight per day for three successive

days. The removed material (pus) was properly decontaminated from the environment. Finally, the ox has successfully recovered after two weeks without any other complications (figure 16).



**Figure 15:** Evacuation of abscess (A, indicates stream like removal of pus while B, shows the amount of pus and the cavity after removal).



**Figure 16:** Status of the ox following management and follow up after two weeks.

## Discussion

An abscess is a pus-filled cavity surrounded by a wall of scar tissue which is developed after a wound is infected by bacteria and cannot drain. The primary cause of abscess can be either from external injuries that can produce wound or from internal infections. But most abscesses are caused by a complication by bacteria to the injured/wound site from the skin, environment and internally from other systemic infections through *haematogenous* route (Misk and Semieka 2016). When the bacteria enter

into the body of animals, their immune system directs infection-fighting white blood cells to the wound area. When these cells (WBC) attack the bacteria, some nearby tissues become died, producing a pocket which then fills with pus to form an abscess that can be classified as either skin abscesses, and internal abscesses which is difficult to diagnose and is more serious type. After abscess has developed, the swollen mass show signs of inflammation namely; swelling, heat, pain, redness and loss of function (Sahoo and Ganguly, 2016; Pressz *et al.*, 2015; Haag *et al.*, 2019). This phenomena is in line with the cause and development of abscess in the current case in which the ox has history of trauma caused by injury that predisposed the development of abscess.

The diagnosis of cutaneous or skin abscesses can be done by history of injury/ trauma or surgery, physical examination and fine needle aspiration or centesis whereas that of deep abscesses often requires imaging/ ultrasonographic examination (Misk and Semieka 2016; Pressz *et al.*, 2015; Wald *et al.*, 2019). This agrees with the diagnosis of the current case report that consists of history of trauma, observation of clinical signs, physical examination by palpation and centesis by a sterile needle. The result of the isolated bacteria after laboratory analysis of the pus sample from abscesses of the ox in this case report was *staphylococcus aureus* which is in agreement with (Tuffyli and Shekhan, 2012) in cattle while it disagrees with the result of (Al-Harbi, 2011; Mosa *et al.*, 2010) who isolated *pasteurella*, *klebsiella*, *E. coli* and *hypoderma* from subcutaneous abscesses of cattle, sheep and goat.

Appropriate management and ventral drainage of the pus from the abscess area is significant by either opening of the circumscribed abscess after maturation and evacuation of its contents or en bloc excision of abscess approaches as antimicrobial drugs alone are usually ineffective without proper drainage. Local infusion of antibiotics into the abscess is also more effective and systemic antibiotic therapy to suppress other complications and circulating micro-organisms can also provide satisfactory outcomes (Rosati, 2017; Misk and Tarik, 2019; Hassan *et al.*, 2019). This abscess draining management and treatment protocol agrees with the draining and treatment of the current case report that was surgically drained with aseptical opening of the abscess followed by dressing with iodine soaked gauze and intramuscular administration of Penicillin G procaine antibiotic parenterally. This combined surgical draining and antibiotic therapy of abscess fasten the recovery of the affected ox within two weeks. In conclusion, based upon this case report, it can be concluded that successful management of skin or subcutaneous abscess in cattle can be achieved by proper drainage of the pus followed by antiseptic gauze packing and parental administration of antibiotics after isolation of the pyogenic bacteria.

### 3.1.7. *Infectious Bovine Keratoconjunctivitis (Pink eye); a case of a cow and its management*

#### Abstract

Infectious bovine keratoconjunctivitis (IBK) is a contagious bacterial disease of the eye affecting cattle worldwide. This case report describes the case of IBK and its successful treatment in adult cow presented to VTH of AAU-CVMA, Bishoftu on April 06/ 2021 with main complaints of reduced body condition and milk production, restlessness with eye problem. Both physical and clinical examination were carried out and revealed that the cow had developed an epiphora of the right eye with absence of menace, and episcleral congestion with corneal opacity. The EDDIE App-based disease diagnosis resulted in this case as IBK. Bacterial culture from swab samples of the affected right eye revealed the characteristics of *M. bovis*, the etiology of IBK. Based on history, clinical signs and EDDIE App and laboratory diagnosis result, the disease was diagnosed as IBK. Its differential diagnosis was traumatic conjunctivitis, infectious bovine rhinotracheitis and eye worm. The case was treated with 20% oxytetracycline and dexamethasone injection parenterally and gentamicin eye ointment topically, providing an effective outcome in which the cow has completely recovered within 45 days. IBK is a highly contagious ocular disease leading to corneal opacity, primarily caused by *M. bovis* that needs early detection and prompt treatment by effective drugs and proper shading.

**Key words;** *infectious bovine keratoconjunctivitis, Cow, Moraxiella bovis, Pink eye*

#### Introduction

Infectious bovine keratoconjunctivitis (IBK) or pink eye is one of the most common painful ocular infectious disease of cattle characterized by conjunctivitis, lacrymation and varying degree of corneal opacity and ulceration. It has a worldwide distribution by chiefly affecting cattle in which the young being most susceptible and is most common in summer and autumn seasons that it reaches epizootic proportions when flies and dust are abundant and grass is long in these seasons. This disease causes low mortality but high morbidity with the most common complaint of being reduced production and growth rates resulting from painful ocular lesions over the grazing season (Sudheer *et al.*, 2019; WSUE, 2020).

The disease can be transmitted by direct contact with ocular and nasal discharges or mechanically with insect vectors indirectly. Multiple factors including environmental, ultraviolet light, fly population, dust, presence of other pathogens and host factors (age, breed and immunity, unpigmented conjunctiva)

are involved to the risk of increased infection (Samra *et al.*, 2016). IBK is caused by the bacteria, *Moraxella bovis* (*M. bovis*) in the family Moraxellaceae. *M. bovis* is a gram-negative,  $\beta$ -haemolytic, aerobic, non-motile, coccobacillus, opportunistic and obligate intracellular micro-organism of the mucus membrane that can be found on the conjunctiva and in nasal and ocular secretions and can survive on the legs of flies for up to three days (Sosa *et al.*, 2015; Constable *et al.*, 2017).

The disease has an incubation period of 2-3 days and often starts with conjunctivitis, lachrymation, epiphora, blepharospasm and corneal oedema. One or both eyes can be involved by showing profuse watery lacrymation accompanied by thick eye discharges at the canthus within 24 hours in which the condition gradually changes worse with severe conjunctivitis, profuse watery or mucopurulent eye discharges followed by photophobia, swelling of the eyelids, matting of eyelashes with smoky or diffuse corneal opacity. The animal shakes the head in attempt to remove flies accompanied with seeking of shade from trees due to photophobia. It causes losses of production (working capacity, milk, meat, wool and fertility, poor growth rates). If affected animals are not treated, ulcers can rupture, leading to prolapse of the anterior chamber (iris) and formation of 'Popeye' calves (Constable *et al.*, 2017; Firdaus *et al.*, 2013).

Diagnosis of IBK can be done by characteristic clinical signs, bacteriological culture of the organism, serological tests; serum agglutination test, and it can be differentially diagnosed from traumatic conjunctivitis, infectious bovine rhinotracheitis, keratitis due to bovine malignant catarrhal fever and eye worm (Behera *et al.*, 2017; WSUE, 2020). It can be treated with ophthalmic ointment containing chloramphenicol, oxytetracycline, gentamycin and streptomycin along with systemic use of a long-acting antibiotic such as tetracycline or florfenicol and subconjunctival injections with procaine penicillin. Anti-inflammatory drug combined with local antibiotic ophthalmic preparation can successfully provide effective outcome (Lakshmanan *et al.*, 2016; Allan and Winden, 2020).

It can be controlled and prevented by isolating and treating cattle showing excessive lacrimation. Provision of shade, lower stocking rates, keeping pasture cut and free of seed heads and fly control has long been the focus of IBK prevention, however, it is not possible to eradicate the disease because of fly population. A vaccine known as "Piliguard" against bacterial pilli to prevent their attachment and invasion to the conjunctiva so as to reduce the incidence and severity of the disease is available in some countries like Australia (O'Connor *et al.*, 2019; Angelos *et al.*, 2016). In Ethiopia, the disease is highly prevent and causes severe economic impact to cattle industry associated with reduced milk and meat

production due to pain and loss of vision, direct costs for treatment and poor aesthetics that affect market price (Seid, 2018), Therefore, the current case report describes a case of infectious bovine keratoconjunctivitis in a cow and its treatment outcome.

#### Description of the case

An adult local breed cow weighing 265 kg body weight which managed semi-intensively was presented to the VTH of AAU-CVMA, Bishoftu on April 06/2021. The major complaints were reduced body condition and milk production, restless, epiphora, symptoms of pain with increased lacrimation and absence of blinking of the right eye. The owner noticed that this animal had an eye problem since 3<sup>rd</sup> of April 2021 and then he decided to treat the animal with a certain local plant extract topically around the eye and by drenching through the mouth before presentation but no change was observed. Physical examination was carried out on the day of presentation and the temperature, respiratory and pulse rates were within the normal ranges, though, there was right eye epiphora which had increased corneal opacity with episcleral congestion. Palpebral/ corneal and menace reflex tests were done on the affected right eye which resulted in the absence of menace reflex that indicated loss of sight of this eye, but there was still presence of palpebral reflex on both lateral and medial aspect of the eye.

Clinical examination also revealed an epiphora of right eye with episcleral congestion, loss of body condition and sight of the right eye (corneal opacity) though, there were presence of palpebral reflex on both medial and lateral aspect of the eye, profuse watery to mucopurulent eye discharges followed by photophobia, swelling of the eyelids and matting of eyelashes with smoky or diffuse corneal opacity (Figure 17). The EDDIE App-based disease diagnosis resulted in this case as infectious bovine keratoconjunctivitis. Based on history, clinical signs and EDDIE App-based disease diagnosis result, the disease was diagnosed as infectious bovine keratoconjunctivitis which is differentially diagnosed from traumatic conjunctivitis, infectious bovine rhinotracheitis and eye worm.

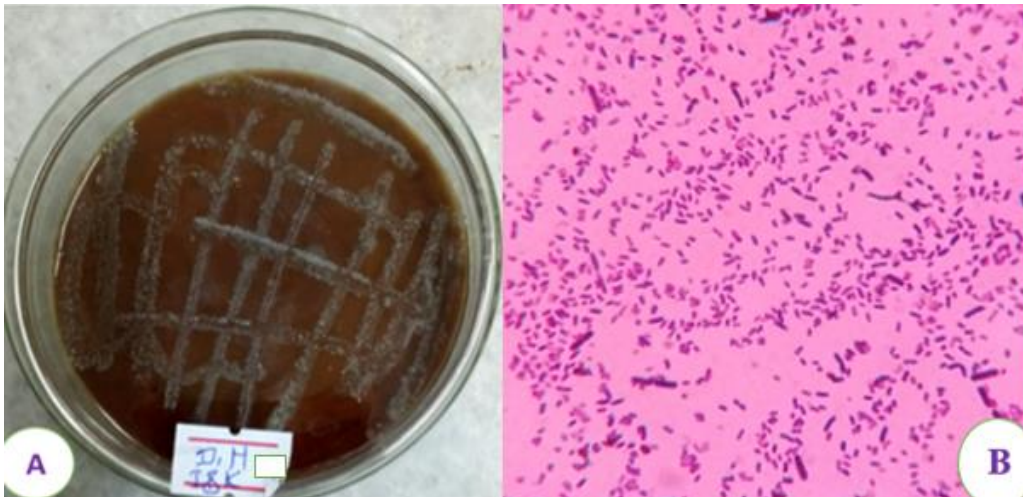


**Figure 17:** Picture of the cow with IBK (A, indicates corneal opacity and lachrymation of right eye, while B, showed symmetrical clean and healthy left eye of the cow).

#### Laboratory investigation and its findings

Lacrimal fluid sample of the affected right eye was taken using a sterile swab and placed into a screw capped vial that contain tryptone soya broth and was sent to the veterinary microbiology laboratory of AAU-CVMA, Bishoftu for bacterial culture, isolation and identification. Then some amount of the sample was inoculated to blood agar base supplemented with 7% healthy sheep blood and incubated at bacteriological incubator at 37 °c for 24 hours after primary enrichment. The bacterial culture resulted the growth of small to medium sized, flat to hemispherical hemolytic colonies after 24 hours (figure 18A) that corrode the agar and often showed surface spreading due to “twitching motility”. But these colonies after 48 hours can become flattened, grey with increased zone of haemolysis.

From the grown colonies on blood agar, pure colonies were taken and smeared on a microscope slide for gram staining and this showed gram-negative pink color rods and cocci in pairs or diplobacillus (coccobacillus or rods) (figure 18B) and upon biochemical tests it showed both catalase and oxidase positive without fermentation of sugars which are the characteristic features of *M. bovis*, the etiology of IBK. Therefore, from history, clinical signs EDDIE App based disease diagnosis result and bacterial culture, isolation and identification, final diagnosis of infectious bovine keratoconjunctivitis was made.



**Figure 18:** Laboratory results of IBK suspected cow (**A**, indicates the growth of *M. bovis* on blood agar while **B**, showed its characteristic result of gram staining).

#### Case management and its treatment outcome

Antibiotic therapy was started with long-acting oxytetracycline (Hebei Huarun pharmacy Co., Ltd. China) at the dose rate of 20mg/kg body weight once a day for three days repeated after every other day intramuscularly since 20% oxytetracycline is a long acting broad spectrum antibiotic that can be active against other micro-organisms (mycoplasma, chlamydia and acholeplasma or other rickettsia) suspected to cause IBK in addition to *M. bovis*. Gentamycin eye ointment was also administered with two drops qid a day within 6 hours interval for seven days after proper washing and cleaning of the eye and dexamethasone sodium phosphate injection (Lincoln parenta Ltd, Gujarat, India) at the dose of 1.5ml/50kg body weight IM for three days once a day was additionally used for the management of pain and inflammation. The owner was recommended to isolate the cow from other animals and keep it from properly shaded environment along with provision of clean feed and water. Following this, the animal responded well to the treatment and showed significant improvement within 45 days (Figure 19). There was no epiphora observed with removed corneal opacity of the eye which indicate healing process and both menace and palpebral reflex tests proved positive results.



**Figure 19:** Picture of recovered cow from IBK after 45 days post therapy.

## Discussion

Infectious bovine keratoconjunctivitis or pinkeye is a highly contagious and infectious bacterial disease of cattle that is mostly caused by *M. bovis* but other micro-organisms like mycoplasma, chlamydia, achleoplasma, rickettsia, adenovirus, infectious bovine rhinotracheitis virus and bovine herpesvirus-1 can also cause infectious keratoconjunctivitis leading to corneal opacity. The disease occurs throughout the world and mostly affects young and adult cattle (Zbrun *et al.*, 2011; Constable *et al.*, 2017). Several risk factors are involved in the development of IBK that include; ultraviolet solar irradiation, dust and wind, high face fly population, mechanical irritation, breeds lacking eye pigment, poor host defense mechanism, virulent *M. bovis* strain, nutritional deficiencies (vitamin A, copper and selenium), hot months and early rainfall, even though it has been reported in all seasons (Sharma *et al.*, 2018; Samar *et al.*, 2016; WSU, 2020).

There are several virulence factors for *Moraxella bovis*, the etiological agent of IBK that includes haemolysin, pili, proteases and leukotoxin which contributes major role for development of the disease. The pilli of *M. bovis* allows for binding to corneal epithelial receptors, then the bacteria releases virulent enzymes (haemolysin and proteases) that damage the corneal epithelial cells and began to progress and display clinical signs of one of the four stages of IBK (Rogers *et al.*, 2012; Ruehl *et al.*, 1993; Zbrun *et al.*, 2011). This agrees with the current case report in which the cow showed stage III clinical sign of IBK.

The progression of the disease is divided into several stages as follow; stage-I indicates earliest signs like blepharospasm, photophobia, conjunctivitis, epiphora, grey appearance of the cornea and loss of appetite; stage-II occurs within 1-2 days after the onset of stage I and showed small grey central cloudy cornea and later become pink due to vasculature; stage-III indicates corneal ulceration in which the entire cornea will have gray-white to yellow color as observed from the current case report. Yellowish appearance of cornea is due to spreading of inflammation to the inner eye and filling with fibrin. Corneal ulcers are promoted by pore forming cytotoxin (hemolysin/ cytolisin) by the corneal epithelial cells lysis and stage-IV indicates when the ulcer extends completely through the cornea, and the iris may protrude through the ulcer and become stuck in the cornea even after healing process has occurred. Sometimes, perforation of corneal ulcer results prolapse of iris that may result blindness (Postma *et al.*, 2012; Firdaus *et al.*, 2013; Marek *et al.*, 2021).

From the current case report, the clinical signs observed were reduced body condition and milk production, restless, epiphora accompanied by thick eye discharges, symptoms of pain with increased lacrimation, matting of eyelashes and absence of blinking of the right eye, photophobia, blepharospasm, conjunctival congestion and corneal opacity. The case was diagnosed by clinical signs, EDDIE App-based diagnosis and bacteriological culture. The treatment approach used was systemic administration of long-acting oxytetracyclin and dexamethasone injection with gentamicin eye ointment topically. This treatment protocol provided an effective outcome that the health of the cow was improved and complete recovery was achieved after 45 days. This diagnostic and treatment approach is in agreement with the case reports and their management protocols conducted by (Behera *et al.*, 2017; Fonseca *et al.*, 2020; Firdaus *et al.*, 2013). In conclusion, IBK is a highly contagious ocular disease leading to corneal opacity which is primarily caused by *Moraxella bovis* that needs early detection and prompt treatment by effective drugs along with provision of proper shading.

### 3.1.8. Malignant Edema (Gas gangrene); a case of an ox

#### Abstract

Malignant edema is an acute and often extremely lethal bacterial disease of animal species caused by clostridium species. A local breed ox with 290 kg body weight was presented to MVC, Modjo, on April 11/2021 with major complaint of anorexia, depression, weakness, lameness and swelling of the left front quarter first followed by edema of the dewlap that developed due to wound of unknown cause.

Physical and clinical examination revealed fever (41.7°C), increased respiratory rate (32 breathes/minute). There was warm, soft and doughy swelling that pits on pressure up-on palpation firstly at the stifle joint and later extended to the dewlap with marked local erythema accompanied by severe pain at the site of infection. The EDDIE App-based diagnosis revealed the case as trypanosomosis. Laboratory analysis indicated the characteristics of clostridium species. Thus based on history, clinical signs and laboratory results, the case was diagnosed as malignant edema and differentially diagnosed from TRP, quarter ill and abscessation. It was managed and treated by a high dose of fortified procaine penicillin, diclofenac sodium, and multivitamin injections and topical application of iodine at the wound site but unluckily, the ox didn't recover. Malignant edema is an acute deadly wound infection characterized by fever, toxemia and edematous swelling around the wound, requiring further clinical and epidemiological investigations to avoid the losses.

**Key words:** *Clostridium, Malignant edema, Ox, Wound*

## Introduction

Malignant edema (ME) is an acute, generally rapidly fatal toxemia or wound infection most commonly in all ages and species of grazing animals that is caused by one or more pathogenic clostridia species. It is distributed throughout the world and highly prevalent in those areas where soil is heavily contaminated with bacterial spores and is considered to be “exogenous” since microorganisms from the environment gain access to the tissues after skin or mucosal wounds and the development of an anaerobic environment is established (Silva *et al.*, 2016; Kusiluka *et al.*, 2016).

Malignant edema is usually caused by *Clostridium septicum* (*Cl. septicum*) which is an anaerobe, gram-positive, spore-forming organism. However, *Cl. septicum* has been considered as a primary cause of edematous and emphysematous condition but other clostridial spp like *Cl. chauvoei*, *Cl. Perfringens*, *Cl. sordellii* and *Cl. novyi* are also associated with malignant edema indicating mixed infections (Kapustin *et al.*, 2020). *Cl. septicum* and other clostridial spp. with their spores are found in the soil rich in organic matter and high humidity and intestinal contents of animals ubiquitously worldwide and infection generally occurs by contamination of wounds (accident, neutering, castration, shearing, docking, unhygienic vaccination, and parturition) as the most common port of entry through activation of dormant spores from the soil (Parish *et al.*, 1996; Coetzer and Tustin, 2014).

The disease is almost always acute, though sporadically sub-acute and chronic cases can occur. The clinical signs of ME includes; depression, anorexia, weakness, local lesion at the site of infection consisting of a warm, soft, doughy swelling with marked local erythema accompanied by severe pain on palpation in which at a later stage it becomes tense and dark (Junior *et al.*, 2020). The swelling contain edematous and gaseous accumulations that can be palpated as crepitation of the subcutaneous tissue around the infected area, intoxication, high fever (41-42 °c), muscular tremor and usually stiffness and lameness followed by recumbency. The skin of the animal become taut and diffusely red or black with suffusions and bruises. In later stages of the disease, the affected area becomes cold, disappearance of the pain due to necrosis of local nerve endings, and sub-normal body temperatures are common and death occurs in most cases by toxemia and systemic shock between a few hours to 2-4 days after the onset of clinical signs (D'angelo *et al.*, 2020; Constable *et al.*, 2017).

The diagnosis of ME can be done by history of wound, characteristic clinical signs, laboratory confirmation, fluorescent-antibody, staining from tissue smear, clinicopathologic changes at postmortem (dark red, swollen muscle filled with hemorrhagic, proteinaceous exudate and little or no gas). It can be differentially diagnosed from quarter ill, anthrax, abscessation and snake bite (Raymundo *et al.*, 2014; Santos *et al.*, 2019). For the proper treatment, control and prevention of malignant edema, wound management and antibiotics (penicillin, tetracyclines) are important along with supportive treatments such as fluids, anti-inflammatory agents and nutrition. Maintenance of good sanitation during invasive procedures (castration, surgical and obstetric manipulation, shearing, and tail docking) and administering injections is helpful in preventing malignant edema. Immunization by vaccination with a multivalent combined *Cl. septicum*, *Cl. sordellii* and *Cl. chauvoei* vaccines in endemic areas, before they are castrated, dehorned, or docked is also essential (Coetzer and Tustin, 2014; Abdolmohammadi and Zahmatkesh, 2021).

In Ethiopia, malignant edema causes huge economic losses due to productive and reproductive losses, treatment, control and preventive costs, morbidity and mortality of animals. However, all livestock population species at all ages within the country are at risk from endemic and sporadic strain of this bacterial disease caused by clostridia species primarily in cattle, there is no clear picture regarding the diagnosis, treatment and control and preventive measures with available vaccines (Roger *et al.*, 2011; Gazioglu *et al.*, 2018). Therefore, this case report describes a case of malignant edema caused by clostridium bacteria in adult local breed ox.

## Description of the case

A local breed ox with 290 kg body weight was presented to MVC, Modjo, on April 11/2021 with major complaint of anorexia, depression, weakness, lameness and swelling of the left front quarter first followed by subcutaneous edema of the dewlap around the neck region that developed due to wound of unknown cause about a week ago before presented to the clinic. Physical examination revealed body temperature of 41.7°C, respiratory rate of 32 breathes/minute, heart of 84 beats/minute. Palpation revealed a warm, soft and doughy swelling which pits on pressure that was developed first at the stifle joint then extends to the subcutaneous tissue of the dewlap with marked local erythema accompanied by severe pain at the site of infection (local lesion). The skin was taut and diffusely reddish black with bruises and suffusions. During clinical examination the animal (ox) showed depression, anorexia, weakness, salivation, intoxication, high fever (41.7 °C), lameness with stiff gait and swelling at the stifle (front knee) joint (figure 20A) and dewlap around the neck region as indicated from figure 20B below. The EDDIE App-based smart phone diagnosis revealed the case as trypanosomosis. Thus, based on history of the wound and clinical signs, the case was diagnosed as malignant edema which is differentially diagnosed from TRP, quarter ill and abscessation.



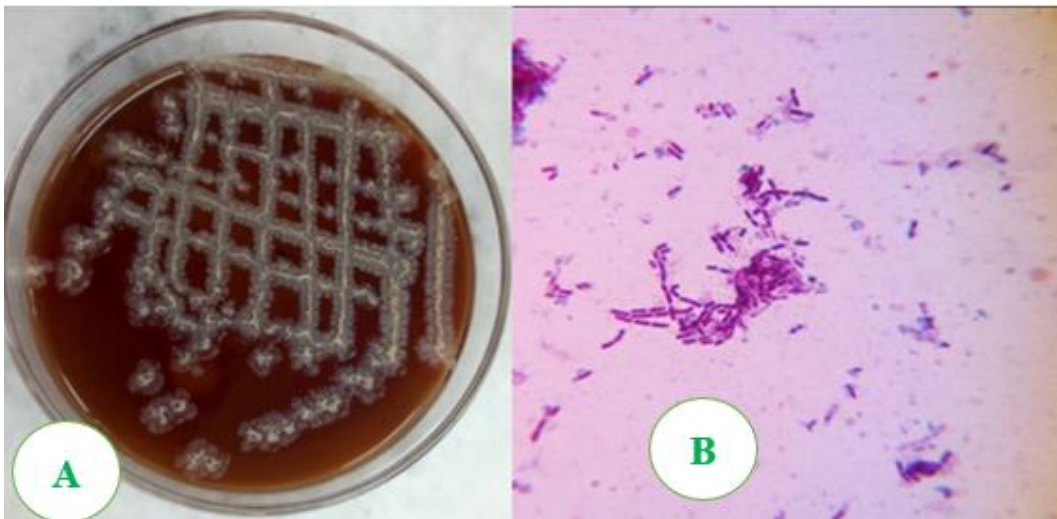
**Figure 20:** Picture of Malignant edema suspected ox.

## Laboratory investigation and its findings

After appropriate physical and clinical examination, samples from swollen content at the dewlap by aspiration with a sterile needle with syringe and blood from jugular vein with anticoagulant coated vacutainer tube were taken and placed in to a screw caped bottle that contained 3ml tryptone soya broth. Then these samples were immediately transported to veterinary microbiology laboratory of

AAU-CVMA, Bishoftu and immediately inoculated to blood agar supplemented with 7% sheep blood in anaerobic condition by placing a lighting candle (to avoid O<sub>2</sub> demand and allow CO<sub>2</sub>) within anaerobic jar. Then the jar was placed in a microbial incubator at 37 °c for two days/48 hours. After 48 hours small, gray-whitish colonies with a thick haemolytic swarming (dense carpet) growth of bacteria were observed (figure 21A). Then, a loop full of pure colony was taken and smear was prepared for gram staining. This stain provide gram positive large rods (figure 21B), the characteristic feature of clostridial species. Both catalase and oxidase results were negative for this micro-organism.

Simultaneously, from the blood and aspirated sample, some amount of the samples were taken and inoculated to similar media (blood agar supplemented with 7% sheep blood) and incubated at 37 °c aerobically for 24-48 hours with oxygen (O<sub>2</sub>) demand, but this condition didn't show any growth of the micro-organism. Therefore, based on history, clinical signs and laboratory result, the disease affecting the ox was diagnosed as malignant edema.



**Figure 21:** Laboratory result of the ox affected by Malignant edema (**A**, indicates growth of clostridium spp. on blood agar and **B**, showed gram stain result of the grown colonies).

#### Case management and treatment outcome

The management and treatment approach used to treat in this case report was intramuscular injection of fortified procaine penicillin (North China pharmaceutical Co., Ltd., Shijiazhuang, China) at the dose of 28, 000 IUs/ kg body weight twice/day for three successive days, an anti-inflammatory diclofenac sodium injection (Hebei depond animal health technology Co., Led, China) at the dose of 2.5 mg/kg/body weight IM for three days and multivitamin administration and topical application of

iodine were used. The owner was recommended to isolate the ox and place it in a hygienic bedding along with provision of clean and fresh feed and water. Unluckily after this treatment protocol, the ox didn't come back to the clinic again for the next day therapy, because it has already died during that night as the owner reported.

## Discussion

Malignant edema is an acute, febrile, sporadic and deadly soil-borne disease of all ages and species of animals that is characterized by acute gangrenous inflammation, oedema and toxemia. It is caused by one or more of the pathogenic species of clostridial bacteria but *Cl. septicum* which is normal intestinal flora of animals and faeces is the most frequent isolates of the disease. Punctured deep wound and severe trauma to tissues due to different factors create anaerobic conditions for the entrance and establishment of the disease. Following entry to tissues, histotoxic clostridia produces tissue-degrading enzymes and hemolytic and necrotizing  $\alpha$ -toxin which contribute nutrient acquisition, evasion of host immunity and tissue damage/ necrosis allowing further proliferation of these microorganisms and production of toxins, which finally spread to the systemic circulation, producing toxemia, shock, and death (Macheak, 2010; Kapustin *et al.*, 2020; Constable *et al.*, 2017). The characteristics and etiology of the current case agrees with the findings of the above literature and the death of the ox could be due to collapse by toxic shock.

Despite, the long history of malignant edema in the veterinary literature to the authors' knowledge, adequate and detailed published information on malignant edema disease regarding its occurrence, diagnosis, treatment and controlling strategies and economic losses in Ethiopia is scarce. Though, in the current case report the clinical signs observed were weakness, depression, fever, intoxication, muscle stiffness, lameness and regional inflammation and swelling at site of a wound. The local swelling typically pits with direct digital pressure and has extended into surrounding subcutaneous tissues, especially to the dewlap and produce edema. Death of the ox has occurred within 24 hours after observation of the clinical signs presented to veterinary facility. Thus, the characteristic swelling and high mortality rate of this infection gives its name, "Malignant Edema" as other authors have illustrated. This agrees with the findings and case reports investigated by (Gazioglu *et al.*, 2018; Santos *et al.*, 2019; Odani *et al.*, 2009; D'angelo *et al.*, 2020).

The treatment of malignant edema should be considered as emergency case as early as possible, because of the acute nature of the disease. Specific treatment can be achieved by the administration of high doses of penicillin (crystalline penicillin) intravenously, repeated at 4 to 6 hours intervals, or other broad-spectrum antibiotic along with antitoxin. NSAID and supportive therapy with surgical debridement are also recommended. Prophylactic antibiotics and vaccination are essential for the control and prevention of the disease (Perdrizet *et al.*, 2012; Constable *et al.*, 2017; Jahani and Rastabi, 2018). This agrees with the treatment protocol of the current case report in which the ox was treated with a high dose of fortified procaine penicillin, and diclofenac sodium injection, multivitamin administration and topical application of iodine solution. In conclusion, malignant edema is an acute and deadly wound infection characterized by fever, toxemia and edematous swelling around the wound, requiring further clinical and epidemiological investigations to avoid the losses due to this disease.

### *3.1.9. Pneumonic pasteurellosis (Mannheimiosis); a case of a ram and goat*

#### Abstract

Mannheimiosis (pneumonic pasteurellosis) is a commonly encountered and wide-spread stress-induced bacterial respiratory disease that causes economic losses to the animal industry. An adult and young local breed male sheep and goat with a history of transportation after a week were presented to VTH of AAU-CVMA, Bishoftu, on January 17 and 20/2021 respectively. Physical and clinical examination indicated fever, respiratory problem with loud and prolonged respiratory sounds, congested mucus membranes, depression, loss of appetite, substantial weight loss. There was coughing, lacrimation and bilateral mucoid nasal discharge in both cases. EDDIE App and laboratory diagnosis revealed the case as pneumonic pasteurellosis. After confirmation based on laboratory, history, EDDIE App and clinical findings, the case was treated and managed by 10% oxytetracycline and 5 % flunixin meglumine. Pneumonic pasteurellosis can occur due to many factors and characterized clinically by acute pneumonia, serous to muco-purulent nasal discharge and fever with toxemia. However, the chances for recovery are higher when treated promptly and affectively by early diagnosis. Proper prophylaxis and vaccination programs are required to prevent and control the losses associated with this disease.

**Keywords:** *Mannheimia haemolytica*, Pneumonic pasteurellosis, Sheep and Goat

## Introduction

Pasteurellosis is a respiratory diseases of domestic and wild animals known by causing pneumonia and septicemia that continues to be a major problem and commonly encountered in small ruminant flocks, affecting groups or individuals of all ages and breeds of animals (Kabeta *et al.*, 2015). Pneumonic pasteurellosis (shipping fever) is stress-induced bacterial respiratory disease which is often fatal and the most economically significant infectious disease that has enormous financial effects on the sheep and goat industry. The disease has a widespread distribution, occurring in temperate, subtropical and tropical climates. It can be transmitted by inhalation of infected nasal secretions, droplet, coughed up or exhaled from infected animals that may be clinical case or recovered carriers where the infection persists in the upper respiratory tract (Abdullah and Chung, 2014; Wilson and Ho, 2013; Rahal *et al.*, 2014).

*Mannheimia* (formerly *Pasteurella*) *haemolytica* is the most common causative agent of pneumonic pasteurellosis (mannheimiosis). It belongs to the family Pasteurellaceae which is small, facultative anaerobic,  $\beta$ -hemolytic, non-spore forming, oxidase-positive, non-motile and fermentative gram-negative short rods/coccobacilli that are common upper respiratory and digestive tract opportunistic commensals (Quinn *et al.*, 2016). This organism has two biotypes, A (arabinose) and T (trehalose); biotype A has 13 serotypes (A1, A2, A5-A9, A11- A14, A16, and A17) while biotype T has 4 serotypes (T3, T4, T10 and T15) in which serotype A1 and A2 are typically species-specific in their potential to induce lower respiratory disease that are most prevalent and main causes of pneumonic pasteurellosis in cattle and small ruminants respectively. *M. haemolytica* is the most commonly isolated bacteria in clinical cases, followed closely by *Bibersteinia trehalosi* and *Pasteurella multocida* (less frequently) (Klima *et al.* 2017; Abed *et al.*, 2020; Quinn *et al.*, 2016).

The pathogenesis involves many predisposing factors like infection by viruses, other bacteria and lungworms, environment or stress associated factors that alter the upper respiratory tract epithelium and develop an acute disease (Rahal *et al.*, 2014). The clinical signs manifested in animals infected with pneumonic pasteurellosis include high fever (42 °C), nasal discharges (initially watery and later purulent), frothy mouth and crusted eyes, cough and dyspnea, depression, laboured breathing and increased respiratory and heart rate, reddening of mucous membranes, conjunctivitis (runny eyes) (Achard *et al.*, 2018; Constable *et al.*, 2017).

At postmortem, subcutaneous hemorrhages, epithelial necrosis of pharynx and other GI organs are observed while anteroventral portions of the lung become dark red, swollen and hard (marked consolidation) and covered with fibrin, adhesion between adjacent pleural surfaces and the bronchi contain fibrin, mucus, blood clots and pus (Abdullah and Chung, 2014). So that, the diagnosis of pneumonic pasteurellosis can be made based on history (management factors), clinical signs, post-mortem and histopathological results, isolation of the bacteria, serological and molecular diagnostic techniques It can be differentially diagnosed from CCPP, lung abscess, tuberculosis and lung worm (Ahmed *et al.*, 2017; Constable *et al.*, 2017).

The disease in early case can be treated effectively with ampicillin, oxytetracyclines, trimethoprim-sulfamethoxazole, ceftriaxone, ceftiofur and enrofloxacin combined with parenteral fluids and suitable anti-inflammatory agents (Thiry *et al.*, 2014; Constable *et al.*, 2017). However, prevention and control plans remain more efficient, which includes improving husbandry and biosecurity procedures, isolation and treatment of clinically affected cases, avoid stressors, and vaccination and prophylaxis (Politis *et al.*, 2019). However, updated and exact information is lacking in Ethiopia, the economic loss due to pneumonic pasteurellosis in small ruminant animals is assumed to be estimated very high irrespective of high sheep and goat population. This limits the economic return of the country by causing different expenses that includes diagnostic and treatment cost, reduced food conversion, greater cost of production and reduced food supply for the people there by creating frustration to veterinary practitioners and ruminant producers (Rico *et al.*, 2017; Jilo *et al.*, 2020). Thus the current case report describes the case of pneumonic pasteurellosis in a ram and goat and its treatment outcome.

## Description of the cases

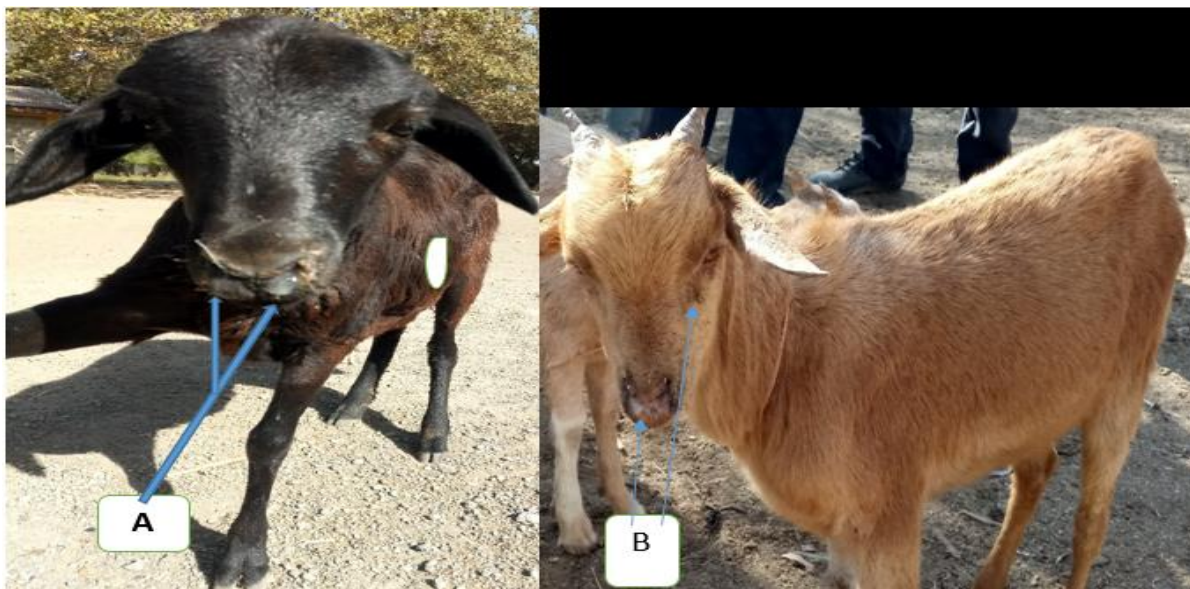
### *Case 1*

An adult local breed male sheep/ram with a history of transportation which was bought from the market of Modjo town and transported to Bishoftu town after a week, was presented to VTH of AAU-CVMA, Bishoftu, on January 17/2021. Up on physical examination, the value of vital parameters indicated fever (body temperature of 41.2°C), elevated heart rate (88 beats/minute), increased respiratory rate (40 breaths/minute) and congested mucus membranes, and on auscultation, respiratory sounds were loud and prolonged. The clinical findings observed were depression, loss of

appetite, substantial weight loss, abnormal breathing accompanied by coughing, fever and bilateral mucoid nasal discharge as indicated in figure 22A.

### *Case 2*

A young male local breed goat, which was bought from the market around Bishoftu town with a primary complaint of respiratory problem, was presented to VTH of AAU-CVMA, Bishoftu, on January 20/2021. The owner also stated that the goat is managed intensively confined at home with other animals by feeding any type of feed that he gave to it. During physical and clinical examination, the goat showed body temperature of 41.4 °c (fever), 92 beats/minute of heart rate, 44 breaths/minute of respiratory rate with abnormal breathing and loud and prolonged respiratory sounds and it manifested clinical signs of depression, rapid shallow breathing, cough and dyspnea, rough hair coat, reduced feed intake and body condition, increased heart rate, lacrimation and crusted eyes, laboured breathing and mucoid bilateral nasal discharges (figure 22B) and conjunctivitis (runny eyes). In both cases (case 1 and 2), the EDDIE App-based diagnosis resulted the cases as pneumonic pasteurellosis. Therefore, based on history, clinical signs observed and EDDIE App-based diagnosis result, the case was tentatively diagnosed as pneumonic pasteurellosis which is differentially dignosed from lung worm and contagious caprine pleuropneumonia.

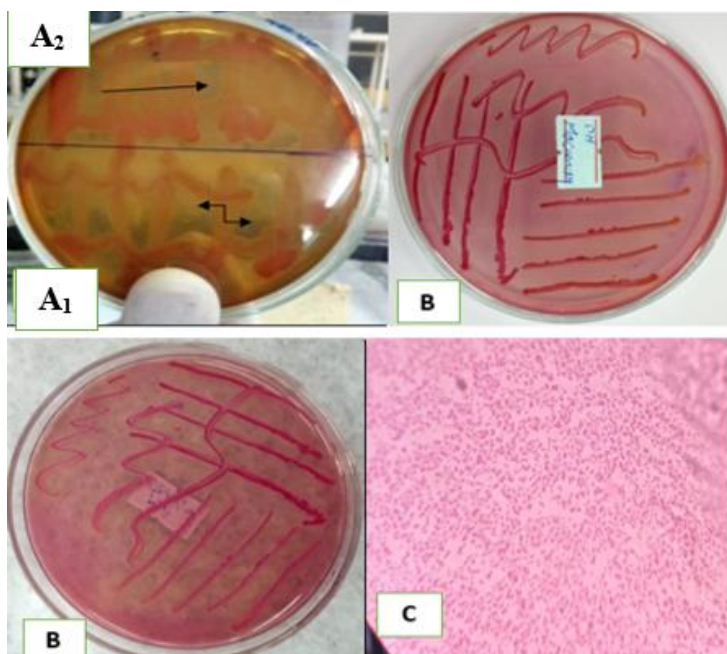


**Figure 22:** Pictures of Mannheimiosis suspected ram and goat (**A**, mucoid nasal discharge from ram and **B**, mucoid nasal discharge, rough hair coat and conjunctivitis with lacrimation from goat respectively).

## Laboratory investigation and its findings

Nasal swab samples were collected from suspected sheep and goat after cleaning and disinfecting the nostrils with cotton wool soaked in 70 % ethyl alcohol. Then sterile cotton-tipped swab in screw-capped test tube moistened with tryptone soya broth was inserted into the nostrils and swabs were taken by rubbing and rotating the mucosa surface and then placed back into 3ml of sterile tryptone soya broth in universal tubes and transported immediately to microbiology laboratory of AAU-CVMA, Bishoftu for isolation. Then after enriching overnight at 37 °C, the samples were inoculated to blood agar base supplemented with 7% sheep blood and incubated at 37 °C for 24 hours. After incubation growth of bacterial colonies showed the morphology of *M. haemolytica* ( $\beta$ -hemolysis, grayish, medium-sized, odorless, moist and non-mucoid) as indicated from figure 23A.

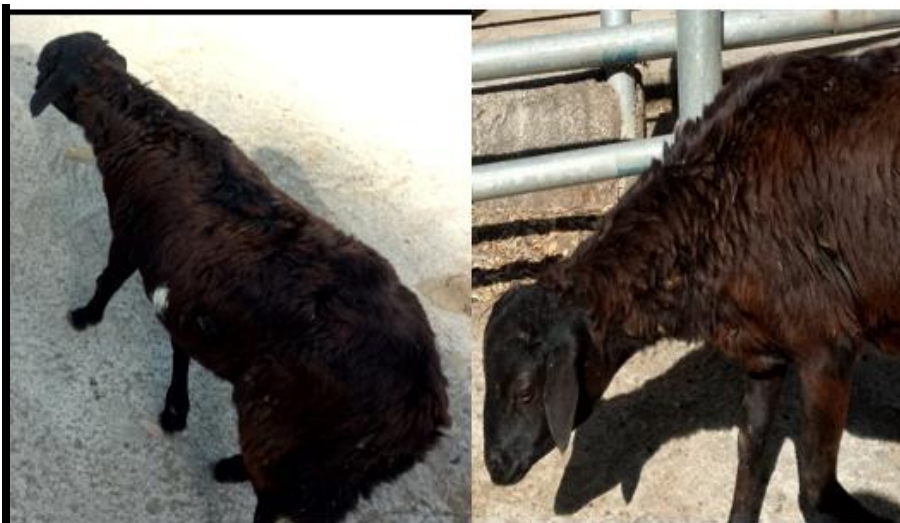
From blood agar, a loop full of grown colony was transferred to MacConkey agar and incubated at 37°C for 24 hours and showed a growth of pink colored colonies (lactose fermenting) as indicated from figure 23B. From these colonies smears were made with gram's staining and examined under oil immersion given a result of gram-negative, short rods or coccobacilli (figure 23C). Biochemical tests indicate oxidase and catalase positive and methyl-red, voges-proskauer and indole negative, no citrate utilization and H<sub>2</sub>S production with sugar fermentation (annex 3).



**Figure 23:** Laboratory results (A (A<sub>1</sub> for sheep and A<sub>2</sub> for goat), from blood agar, B, indicates from MacConkey and C, corresponding gram stain result).

## Case management and treatment outcome

This case was medically managed by short-acting oxytetracycline (phenoxy 10%) injection (KELAN. V. manufacturer, Hoogstraten, Belgium) at a recommended dose of 1ml/10kg body weight once a day for three consecutive days IM and 5% flunixin meglumine injection (Zoetis UK limited, London) with a recommended dose of 1.1mg/kg once a day for two days IV until the body temperature and pneumonic cough become reduced followed by advising the owner to isolate and keep the animals from well ventilated bedding with good feeding. During daily check up by administering the prescribed drugs, the body temperature of both animals was reduced after two days. After the end of treatment coughing and nasal discharges become stopped and the body temperature was also at the range of normal values. Finally these animals were successfully recovered from the infection as indicated in figure 24 below (the sheep (but the goat was sold as the owner reported)).



**Figure 24:** Recovered ram after a month.

## Discussion

Small ruminants play a great role in the continuous source of income for the rural and semi-urban population in Ethiopia (Wodajo *et al.*, 2020). However, in recent times documented and unpublished information indicated that respiratory diseases mainly of pneumonic pasteurellosis is highly prevalent considered to be a high-priority disease causing significant economic losses through morbidity, mortality and high cost of treatment (Abebe, 2018).

From many of the researches conducted in different times and areas in Ethiopia, *M. haemolytica* is the most prevalent and frequently identified pathogenic cause of pasteurellosis. 87.5% out of 256 samples examined around Eastern Hararghe were *M. haemolytica* (Marru *et al.*, 2013), out of 322 examined positive blood and nasal swabs samples, 79.5% were *M. haemolytica* in Fogera woreda (Tewodros and Annania, 2016), from 384 serum samples 92.45% were *M. haemolytica* positive in selected areas of Tigray (Berhe *et al.*, 2017), and in selected areas of central Ethiopia from 76 pneumonic cases of sheep, 26 were caused by *M. haemolytica* (Legesse *et al.*, 2018). These findings agree with the current case report that both the ram and goat were infected with pneumonic pasteurellosis caused by *Mannheimia haemolytica*. This can be due to that *M. haemolytica* have been reported to be normal flora of the upper respiratory tract in healthy sheep and goats which may play secondary role and favors its multiplication after the primary initiating causes that suppressed the immunity of the host and leading to bronchopneumonia by altering the upper respiratory tract epithelium in purely pneumonic animals.

In the current case, the clinical findings observed in the affected sheep and goat were, depression, loss of appetite, substantial weight loss with rough hair coat, abnormal breathing accompanied by coughing, fever, bilateral mucoid nasal discharges, rapid shallow breathing with dyspnea, lacrimation and conjunctivitis that were developed after history of transportation (a stress factor). These signs were consistent with the clinical pictures associated with *M. haemolytica* infections as reported by other researchers previously by (Tabatabaei and Abdollahi, 2018; Tewodros and Annania, 2016) who find out that stress factors such as transportation, concurrent infections, intensive management and sudden environmental changes increase small ruminant susceptibility to pneumonic pasteurellosis. This can also associated with the diversity of serotypes with the action mediated by different virulent factors of the causative organism and capable of causing pneumonia and high nasal carriage rate in apparently healthy small ruminants.

Administration of antibiotics such as enrofloxacin, ceftriaxone, ampicillin, ceftiofur, sulfadiazine-trimethoprim, tetracycline and macrolide combined with parenteral fluids and suitable anti-inflammatory agents are recommended for the treatment and early control of pasteurellosis in small ruminants (Constable *et al.*, 2017; Thiry *et al.*, 2014; Chung *et al.*, 2015). This is in agreement with clinical management of pneumonic pasteurellosis caused by *Mannheimia* in a ram and goat with a broad spectrum antibiotic, short acting oxytetracycline intramuscularly in the current case. Besides antibiotic therapy, flunixin meglumine (NSAID) intravenously as anti-inflammatory and analgesic therapy was also used. Thus the above combined antibiotic and anti-inflammatory therapy of

pneumonic pasteurellosis in the infected animals has provided a better outcome for recovery of the ram and goat in the current case.

In conclusion, pneumonic pasteurellosis which is characterized clinically by acute shipping fever pneumonia, serous to muco-purulent nasal discharge and fever with toxemia can occur due to many factors. However, the chances for recovery are higher when the affected animals are treated promptly and effectively in which early diagnosis and treatment and proper vaccination program are required to prevent and control the losses associated with this disease.

### **3.2. Case Reports on Parasitic Diseases of Livestock**

#### *3.2.1. Ascariasis; a case of a horse and its treatment outcome*

##### Abstract

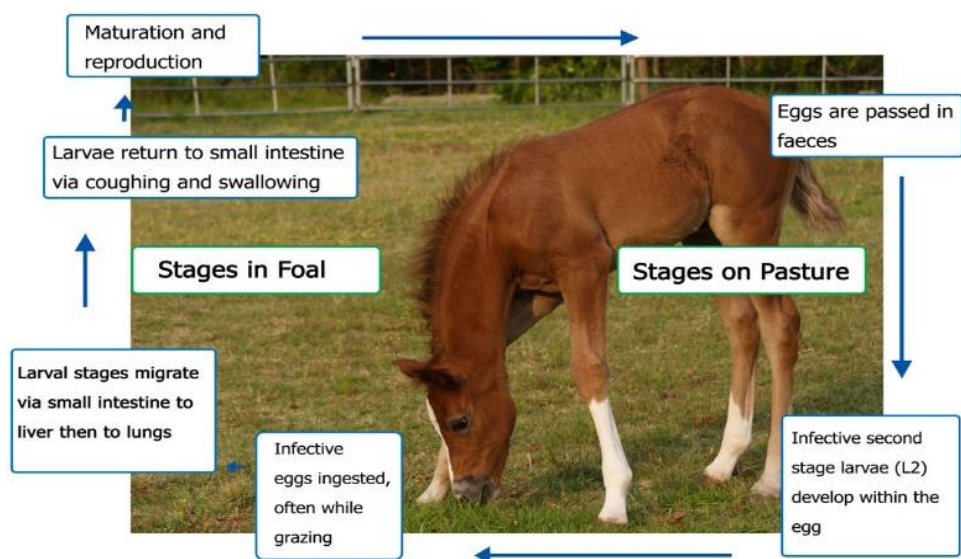
Gastrointestinal nematodes, mostly ascaris that can cause small intestinal impactions in horse, occurs ubiquitously and present a major economic concern throughout the world. An adult male horse was presented with a major complaints of reduced body condition and working power and frequent rolling. The horse has no history of regular deworming and other treatments. Up-on physical examination, the horse showed increased respiratory rate (26 breaths/minute) and heart rate (72 beats/minute) but others remain within the normal range. The clinical examination revealed, rolling, pawing, hyperemic mucous membranes and expulsion of larvae of ascaris through feces. The EDDIE App diagnosis revealed the case as Ascaris-foals. Fecal flotation technique resulted egg of ascaris. Based on history, clinical signs, EDDIE and laboratory result the case was diagnosed as equine ascaris. This case was treated by ivermectin and flunixin meglumine which enhanced recovery of the horse from the ailment. Ascariasis is one of the most common parasitic diseases affecting many animal species and humans that reduces the productive performance of animals limiting economic growth. Therefore, it needs early diagnosis along with regular/strategic deworming and targeted treatments with proper feeding and hygienic measures to reduce the losses.

**Key words;** *Ascaris, Horse, Parascaris equorum, treatment outcome*

## Introduction

Ascariasis is ubiquitously distributed parasitic infection through contaminated feed, including the grazing pasture, water, and troughs, especially in tropical and subtropical areas. It affects all grazing horses in unhygienic conditions. The disease has a devastating effect characterized by severe debilitation, poor growth, coughing, lethargy, colic, intestinal obstruction or inflammation causing constipation or diarrhea, haemorrhages and even death in untreated cases. But it can be primarily identified by conducting a diagnostic technique using copromicroscopic methods, including qualitative fecal flotation and other advanced methods for selection of appropriate therapy (Eva *et al.*, 2019; Taylor *et al.*, 2015).

Ascariasis is caused by a very large, stout nematode parasite, *parascaris* (*p. equorum* and *p. univalens*) which is the largest nematode that infects horses and donkeys more frequently but it also affects other animals including people. The life cycle of this parasite starts when the susceptible animals mostly foals that graze on a contaminated pasture or other feed and water sources with their troughs or surfaces contaminated by the eggs of ascaris (Dennis *et al.*, 2016). The egg have a thick shell that enable it to remain infective for several years in the environment by contaminating feed and water sources and only hatches after being swallowed by the horse (Nielsen, 2018). The full life cycle is around 10-12 weeks (figure 25).



**Figure 25:** Diagrammatic representation of life cycle for equine ascariasis, adopted from <https://www.faecaleggcountkit.com.au/parasites/ascarid-life-cycle/>.

This parasite immature larvae takes about 14 and 17 days by wandering through the vital organs (liver and lungs). From this site, they are coughed up and reswallowed and eggs are produced as a result of maturation of the larvae in adult worm in the intestine where full developmental stage takes about 11 to 16 weeks to reach adulthood (Anne *et al.*, 2007; Nielsen, 2018). *Ascaris* continued to be a significant health threat to animals and human especially of horses. It lives in the internal organs like intestine, liver and the lungs causing obstruction, damage with haemorrhage and coughing as a result of migration of the larvae. The cornerstone in controlling and preventing this parasite is either by management programs which interrupts the life cycle of the parasite before infestation occurs and sanitation in the stall and feeding and watering areas in addition to proper manure disposal or by use of regular chemical treatment with various types of anthelmintics (macrocyclic lactones, benzimidazoles and tetrahydropyrimidines) that have been developed to eliminate parasites (Macallister and Freeman, 2018; Taylor *et al.*, 2015; Sazmand *et al.*, 2020).

In uncontrolled and poor management conditions, this disease causes severe economic losses by reducing working power, productive loss, diagnostic and treatment costs and death of the horses due to other complications as a result of intestinal obstruction and damage of other vital organs like lungs and liver due to its migratory nature; so that it reduces the income of horse owners in rural and semi urban areas who get daily cash from carting, droughting and transportation which influences their lively hood (Saeed *et al.*, 2019; ESCCAP, 2018). Thus, the current case report describes the impact of *ascaris* in a cart horse and its management and treatment outcome.

#### Description of the case

In this case report, an adult male horse started grazing on a free range pastures and feeding with unhygienic feed through was presented to MVC, Modjo, on December 27/2020. The major complaints were reduced body condition and working power, frequent laying down and dehydration. The owner has also described that the horse has no history of regular deworming and other treatments for about five months. Up-on physical examination, the horse showed increased respiratory rate (26 breaths/minute) and heart rate (74 beats/minute) but other parametres remain within the normal range. The clinical examination revealed rolling, pawing, potbelly appearance, hyperemic mucous membranes and expulsion of the larvae of the parasite (*ascaris*) (figure 26) during rectal palpation/examination for intestinal and other lower gastrointestinal tract problems and for collection of fecal sample. Based on history, clinical signs and EDDIE App result, the case was diagnosed as

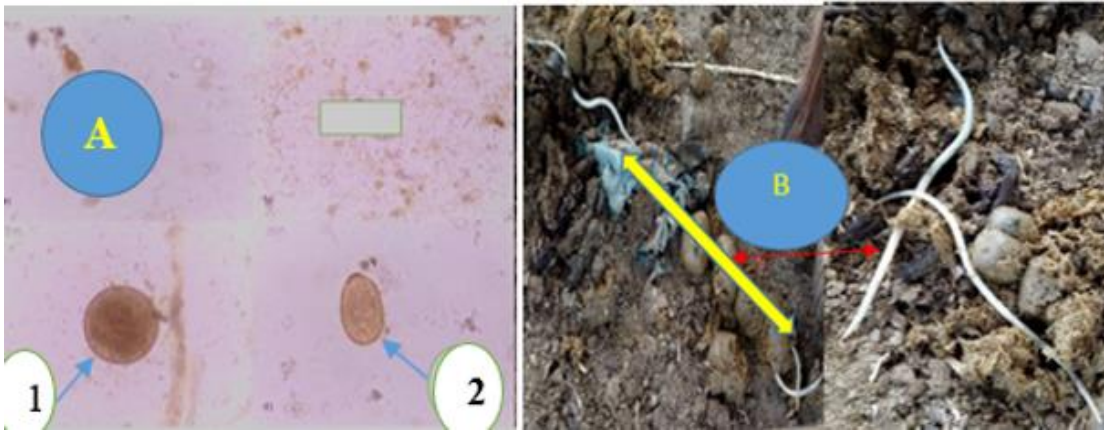
equine ascaris which is differentially diagnosed from impaction, colic due to other GIT parasites and intestinal problems.



**Figure 26:** picture of the horse infected by ascaris (A, expelled worm through the feces, B, potbelly and laying down (colic) of the horse).

#### Laboratory investigation and its findings

Even though, the case was diagnosed as equine ascaris due to of expulsion of the larvae through feces, fecal sample was taken directly from the rectum of the horse and placed on universal bottle. Then transported to parasitology laboratory of AAU-CVMA for demonstration parasitological floatation to confirm and check whether the horse is affected by other gastrointestinal parasites concurrently. Then floatation of the fecal sample resulted a mixed parasitic infection of the horse by ascaris and other nematodal parasite (27A).



**Figure 27:** Picture of laboratory result of the horse (**A**, indicates ascaris egg (**1**) and other parasitic egg (**2**) while **B** showed expelled worm).

#### Case management and treatment outcome

This case was managed and treated by an endoectocidal anthelmintic drug, ivermectin 1% (Hebei hope pharmacy pharmaceutical Co., Ltd, China) with a dose of 0.2mg/kg per os/orally once a day for two days with an interval five days and 5 % flunixin meglumine solution injection (Zoetis UK limited, London) at a dose of 1.1mg/kg for three successive days once a day IV was used in order to relieve the pain (colic) and inflammation produced by the irritation and pressure due to luminal occlusion of intestine and migration of the larvae. The owner was advised to give an adequate time for rest by providing proper feeding with comfortable bedding and not to pull a cart until the horse recovered from its deviation of the normal condition. Following the above management and treatment protocols, the horse has recovered from the ailment after fifth day visit (figure 28 below).



**Figure 28:** Recovered and active horse after therapy (**A**, at third day and **B**, fifth day visits).

## Discussion

Ascariasis by itself cannot be a life threatening disorder alone that affects equines leading to death without giving time for treatment. But, it causes other systemic disturbances or complications and physical damage, inflammation and scarring of liver, heart and lung tissue causing coughing and hemorrhages. This could be due to the migratory capability of the larvae via the bloodstream and lymphatics (Alfonso and Shannon, 2017). Direct gastrointestinal tract damage from adult worms can cause functional disturbances in the intestinal and associated structures that ranges from minor digestive irritations and decreased feed absorption to intestinal blockage and subsequent colic that leads the animal to lay down frequently (Drudge and Lyons, 2019; Clayton and Duncan, 2018). This agrees with the current case report, that the horse showed repeated laying down which interferes feed intake leading to reduced body condition, and working power of the animals. This intern limits the daily economic income of the owners and the country's growth as well.

Young foals are predominantly affected by *parascaris equorum* and developed significant clinical signs compared to adults that generally develop resistance (Lindgren *et al.*, 2018). Unlike to the above finding, the clinical disease of ascaris in the current case was developed in adult working horse which could be possibly due to reduced immunity as a result of physiological stress, lack of regular deworming and poor husbandry practices.

It is commonly reasoned that animal density and pasture availability has strong effect on parasite occurrence along with other important factors (favorable temperature and moisture). This contributes suitable environment for development of parasitic eggs that were considered to remain as a constant source of infection to infective stage larvae (L3) (Othman and Alzuheir, 2019; Premaalatha *et al.*, 2018). During the study of this case, there was an erratic rain fall for two days which makes the weather conditions favorable and within the expected range that activates resistant ascaris eggs which were surviving under harsh conditions. This makes the pastures and other environments to become continually contaminated with parasite eggs for grazing seasons and make grazing pasture as the best contributing factors to cause a disease in horses kept under grazing system without supplementary feeding conditions sharing with a common grazing environment like the horse in the current case.

The management and treatment of the majority of uncomplicated cases of equine ascariasis can be successfully done with anthelmintic (antiparasitic) drugs such as macrocyclic lactones, benzimidazoles

and tetrahydropyrimidines (Taylor *et al.*, 2015; Sazmand *et al.*, 2020). However, complicated cases of ascariasis like intestinal obstruction, volvulus and others can be managed by different surgical interventions like enterotomy (Wormstrand *et al.*, 2014). The current case was managed and treated with ivermectin which blocks the parasite's nerve transmission, causing paralysis and death. Colic was developed due to the pain as a result of occlusion of the lumen of the intestine and inflammation as a consequence of irritation and migration of the larvae. Then it complicates the condition and leads to death of the animals (horses) in untreated conditions (ESCCAP, 2018). However, in the current case, the horse with frequent laying down, indicating severe colic was managed by flunixin meglumine which helped the horse to recover in short time. This agrees with other findings that were done on the management of equine colic due to parasites and other factors by (Belay and Teshome, 2016; Anne *et al.*, 2007; Hedberg-Alm *et al.*, 2020).

In conclusion, ascariasis is one of the most common parasitic diseases affecting many animal species and human, characterized by weight loss or poor growth, colic, coughing, rough hair coat, and poor performance with production loss. It needs early diagnostic test along with regular or strategic deworming and targeted treatments with proper feeding and hygienic measures.

### *3.2.2. Haemonchosis; a case of six sheep from a flock*

#### Abstract

Haemonchosis is highly pathogenic, most prevalent and economically important blood-sucking parasitic disease of small ruminant animals. Six different ages and sex group local breed sheep were presented to VTH of AAU-CVMA, Bishoftu, on February 24/2021 with a primary complaint of depression, weight loss, swelling beneath the jaw and frequent diarrhea. As the owner stated, the sheep were managed semi-intensively by feeding, leaves and weeds grew when irrigation was used to cultivate flowers. Physical and clinical examination showed vital parameters were within the normal range but reduced body condition, depression, pale mucous membrane, bottle-jaw and dark greenish diarrhea that soiled the perineal region of the sheep. EDDIE App-based diagnosis revealed the case as fasciolosis. Faecal floatation proved thin shell embryonated parasite eggs and hematocrit centrifugation of blood indicated 22% of PCV. Therefore, based on history, clinical and laboratory findings the sheep were infected by haemonchosis. The case was managed medically by ivermectin and ringer's lactate fluid transfusion for severely affected one. Post-treatment progress showed that the sheep become

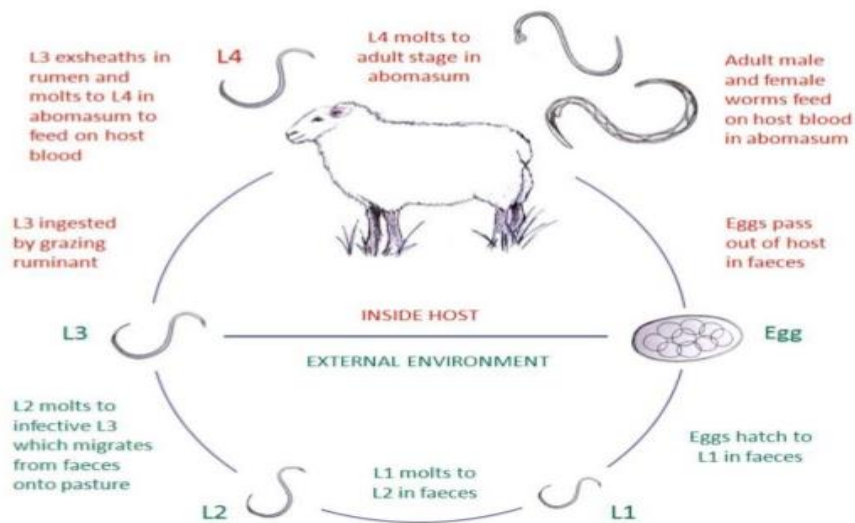
completely recovered. The current case study revealed that haemonchosis is a common parasitic and economically important disease of sheep that requires rapid diagnosis, appropriate therapy, pasture management and strategic prevention to maintain flock health protocols.

**Key words;** *Bottle-jaw, sheep, Haemonchosis*

## Introduction

Among different types of parasitic diseases, gastrointestinal nematodes are the most destructive pathogenic infections affecting small ruminants industry, given the high prevalence of flocks and serious infection implications (Villarroel, 2013). Haemonchosis/barber's pole disease is a highly wasting and pathogenic problem of ovine production that causes severe clinical disease and death if a rapid intervention is not done in early stages of the disease. A blood-sucking nematode parasite, *haemonchus species* that cause it use the abomasum as a predilection site. This disease produces a major economic limiting factor by reducing of cash income, meat, milk, skin, wool products, and expensive treatment costs and control measures globally, including Ethiopia (Taylor *et al.*, 2015; Tesfaheywet and Murga, 2019). The disease induces a life-threatening problem in a severe infection of untreated cases in the warm temperate and tropical countries by causing high morbidity and mortality (Qamar *et al.*, 2009; Dennis *et al.*, 2016).

It is caused by a nematode parasite, *haemonchus species* in the family Trichostrongylidae. *Haemonchus contortus* (*H. contortus*) is the most common etiologic agent of haemonchosis in sheep but other species (*H. placei*, *H. similis*, *H. bedfordi*, and others) also contribute a role for the occurrence of the disease in many of domestic and wild animals in different agro ecological areas ( Taylor *et al.*, 2015; Hoberg *et al.*, 2014; Zarlenga *et al.*, 2016). The disease is transmitted through grazing of moist contaminated pastures which are highly favorable for the growth and multiplication of parasites. The life cycle of haemonchosis is direct and begins after sexual reproduction of adult male and female worms in the host abomasum and the female worm starts to shed embryonated eggs (5000 to 15,000 per female/day) (Khattak *et al.*, 2014). The general life cycle (egg to mature adult) of this disease lasts about 17-21 days (Machen *et al.*, 1998), as clearly indicated in figure 29 below.



**Figure 29:** Diagrammatic representation of life cycle of ovine haemonchosis, adopted from <https://www.slideshare.net/DhavalChaudhary7/haemonchus-contortus>.

Haemonchosis can occur in acute and/or chronic forms which is clinically characterized by weakness, lethargy, anorexia, chronic wasting (emaciation), submandibular swelling (bottle jaw), severe anemia (loss of 200–600 ml blood/day), decreased production, dark greenish diarrhea and even death of infected animals if not treated (Simpson, 2021). The clinical diagnosis of haemonchosis can be done by clinical signs, microcoproscopic examinations or eggs per gram (high fecal egg counts, up to 10,000 EPG), hematology, molecular and postmortem findings. It can be differentially diagnosed from fasciolosis, abscess, babesiosis and anaplasmosis (Puspitasari *et al.*, 2016).

Basic principles in the therapeutic management of clinical cases of haemonchosis are to correct or manage anaemia, dehydration and diarrhea (Jesse *et al.*, 2019). Treatment and control of haemonchosis is based on the application of broad-spectrum anthelmintic groups which are active against different stages of the parasite's lifecycle. Anthelmintics like macrocyclic lactones, benzimidazoles, imidazothiazoles/tetrahydropyrimidines, salicylanilides and substituted phenols and combination anthelmintic are effective against this disease but the disease has developed resistance to some of these drugs when they are given in a reduced doses (Kaplan and Vidyashankar, 2012; Constable *et al.*, 2017). The disease can be also controlled by nonchemical/therapeutic techniques like by grazing and nutritional management. Marketable vaccine known as wirevax in South Africa or barbervax in Australia has become available in latest times. This vaccine acts mainly by reducing production of egg and hence contamination of the pasture (MRI, 2019; Ehsan *et al.*, 2020).

The disease causes huge economic losses in different species of animals especially in sheep and goat production in different parts of the world and it is a common cause of death in warm moist climatic conditions because pastures become more actively contaminated from hypobiotic larvae which were metabolically inactive in dry periods (Melnychuk, 2019; Taylor *et al.*, 2015). Even though the losses caused by this parasite is believed to be significant, exact and up-to-date estimates of the economic influences are deficient in Ethiopia. Available information showed that infections by *Haemonchus contortus*, is responsible for important morbidities and mortalities in small ruminants in different parts of the country (Tesfaheywet and Murga, 2019). Thus, the current case report describes clinical cases of haemonchosis in sheep.

#### Description of the case

Out of around 450 sheep in a flock from one of privately owned farms located in Koftu peasant association around Bishoftu town, six different age and sex group local breed sheep were suspected by a certain disease and presented to VTH of AAU-CVMA, Bishoftu, on February 24/2020. The primary complaints were depression, weight loss, fluid swelling beneath the jaw and frequent diarrhea. As the owner stated, the sheep were managed semi-intensively by feeding “frushka, leaves and weeds those grew when irrigation was used to cultivate flowers” as commercial purpose. Vital parameters (body temperature, pulse/heart rate, respiratory rate and others) were within the normal values. Clinical examination findings revealed that the sheep were emaciated, dull and depressed, have pale mucous membrane (figure 30C), bottle-jaw (figure 30B) and dark greenish diarrhea that soiled the perineal region of the sheep (figure 30A). The EDDIE App-based diagnosis revealed the case as fasciolosis. Therefore, based on history and clinical signs, the current case was diagnosed tentatively as ovine clinical haemonchosis which is differentially diagnosed from fasciolosis, abscess, babesiosis and edema.



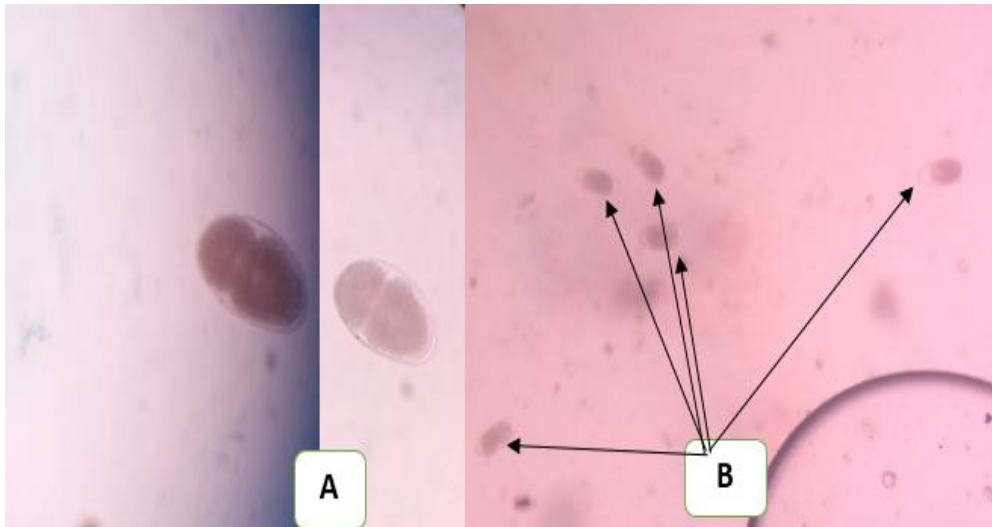
**Figure 30:** Haemonchosis suspected sheep (**A**, indicates diarrhea soiling ewe’s hind leg, **B**, showed bottle jaw while **C**, indicates pale mucus membranes/anemia).

#### Laboratory investigation and its findings

Faecal samples were collected by wearing a sterile glove directly from the rectum of the sheep and immediately transported to parasitology laboratory of AAU-CVMA, Bishoftu, after placing them with a sterile universal bottle with unique labels. Then, the samples were processed and examined by faecal floatation techniques (3 grams of faeces were dissolved with 42ml of floatation fluid (magnesium sulphate) and stand for 15-30 minutes after filling the test tube and covering/putting cover slip on it) for the presence of haemonchus species eggs as described by (Samad 2008). Eggs of haemonchus species were identified under a microscopic magnifications of objective lens X10 and X40 as indicated from figure 31A and 31B respectively. On the basis of morphology eggs are thin shelled, embryonated and oval shaped (Urquhart, 2000). Simultaneously, faecal sedimentation was also conducted but the result was negative.

Blood sample was also collected with EDTA coated vacutainer tube from jugular vein of one of severely affected ewe and transported to veterinary clinical pathology laboratory of AAU-CVMA for analysis and determination of PCV by centrifugation (10,000 rpm for 5 minutes) by gently mixing the blood and filling 3/4<sup>th</sup> of hematocrit’s length by capillary action and one end sealed as described by

(Bull *et al.*, 2000). Finally placed on the hematocrit reader and indicate a reading value of 22% (normal PCV ranges of sheep is 27-45%), showing anemic condition of the sheep. Therefore, based on history, clinical signs and laboratory findings, the sheep were finally infected by haemonchosis.



**Figure 31:** Faecal floatation result of haemonchosis suspected sheep (**A**, indicates 10X magnification and **B**, by 40X magnification).

#### Case management and treatment outcome

The case was managed medically by ivermectin at a dose of 0.2mg/kg (Hebei hope harmony pharmaceuticals Co., Ltd, China) two doses once a day repeated after 12 days subcutaneously, and intravenous institution of lactated ringer's solution (Aculife healthcare Pvt. Ltd. Gujarat, India) for dehydrated sheep due to losses by diarrhea and others (figure 32 below). At the second visit, diarrhea was stopped and the sheep were returned to their normal feeding status. Communicating with the owner, and at the final visit of this study, post-treatment progress showed that the condition of the sheep was improved and fully recovered from the infection. The owner also reported that no sheep was died in the flock until three months in relation to this disease.



**Figure 32:** Intravenous rehydration of severely affected ewe.

### Discussion

Gastrointestinal (GI) parasitic infections are a huge global problems for both small and large-scale livestock farmers. They cause body condition loss, impaired fecundity/fertility, dropped immunity, impaired gastric function and high mortality rate, leading to immense economic losses (Simpson, 2021). Among these diseases, haemonchosis is one of the major blood-feeding parasitic disease of small ruminants that can result severe dehydration, anemia and oedema leading to death of infected animals mainly during warm, humid climates if prompt intervention is not done in early stages of the disease. The development and prognosis of this disease depends on numerous factors like burden of parasitic infection, age, management and immunity of the host. The major pathogenic mechanisms of *H. contortus* parasite is causing a direct damage to the gastric mucosa and subsequent blood sucking, causing hemorrhagic anemia. It has been estimated that each adult worm sucks about 0.05 ml of blood/day by ingestion or seepage from lesions (Urquhart *et al.*, 2000; MRI, 2019).

The occurrence of parasitic disease depends on ecology, geographical, agro-climatic conditions and features of seasonal dynamics associated with movements of sheep but the most common factors that predispose for haemonchosis development include overcrowding, grazing on lush pasture, hot and humid weather and a low plane of nutrition (Besier *et al.*, 2017). It was noted that temperature, relative humidity and rainfall are the most important components creating favorable conditions for laying and hatching of eggs and survival of the infective stage of larvae in the month of wet season on the pasture (Melnychuk, 2019). However, in the current case, the disease has developed in dry season (end of February) which can be associated with, flock density and poor environment that has been contaminated with high infective larvae, due to different management system that the sheep were semi-

intensively managed by feeding green lush leaves of flowers, weeds and pasture from wet irrigated lands that were used for commercial flower cultivation assumed to be contaminated by parasitic eggs.

The 1<sup>st</sup> and 2<sup>nd</sup> stage larvae are free-living organisms but the host ingests the larvae of 3<sup>rd</sup> stage that cause beginning of the infection and developed to 4<sup>th</sup> stage larvae and adult parasite which localized on the surface of the mucosa or lining of the stomach by sucking blood. It affects all ages of sheep but lambs are more susceptible to be infected by this disease than adults and the disease lasts about 2-3 weeks to develop clinical disease (Taylor *et al.*, 2015; Khattak *et al.*, 2014). In the current case, the clinical signs manifested were reduced body condition, dullness and depression, pale mucous membrane indicating anemia, bottle-jaw (swelling at the ventral side of the neck) and dark greenish diarrhea that soiled the perineal region of the sheep, which are indicators of chronic haemonchosis. As the above clinical signs gave a clue for tentative diagnosis of the current case as haemonchosis, fecal flotation, and PCV value from blood centrifugation has confirmed the case. This agrees with other findings conducted by (Besier *et al.*, 2016; Jesse *et al.*, 2019).

Clinical cases of haemonchosis can be managed based on the application of broad-spectrum anthelmintics which are effective against different stages of the parasite's lifecycle (Dennis *et al.*, 2016; Constable *et al.*, 2017). This disease can be also controlled and prevented by proper pasture management with good nutrition that helps to reduce the emerging anthelmintic resistance larvae, and regular deworming for the control of the severity of heavy parasitism (Puspitasari *et al.*, 2016; Jesse *et al.*, 2019; Besier *et al.*, 2017). These findings agree with the therapeutic management of the current case report by ivermectin which is a broad spectrum macrocyclic lactone anthelmintic effective against both internal and external parasites that have developed resistance to other anthelmintics like benzimidazoles. It acts by causing paralysis and death of the parasite either directly or by causing the worms to be starved as a result of hyperpolarization (Puspitasari *et al.*, 2016). Additionally, fluid replacement by ringer's lactated solution for losses due to diarrhea and parasitic feeding was done; that make the sheep to recover efficiently with short time.

In conclusion, the current clinical case study revealed that haemonchosis is a common parasitic and economically important disease of sheep in the area that requires rapid diagnosis, appropriate therapy, pasture management and strategic prevention to maintain flock health protocols and to control this wasting disease in the country.

### 3.2.3. Bovine trypanosomosis; its management and treatment outcome in an ox

#### Abstract

Trypanosomosis is the most devastating and neglected protozoan disease of various animals, transmitted mainly by tsetse fly vectors and causes severe economic losses. A local breed ox with body weight of 260 kg was presented to MVC, Modjo, on March 28/2021 with a major complaint of rough hair coat, minor wounds on the body, loss of condition, lagging, and with history of transportation by car and on limb where it was bought around the southern part of Oromia region. The owner also stated that the ox was managed semi-intensively and that multiple wounds on it may be due to birds pecking. Physical and clinical examination was carried out, indicating normal vital signs. There was generalized enlargements of prescapular and prefemoral lymph nodes, pale mucous membrane and weight loss. The EDDIE App-based diagnosis and stained blood smears revealed the case was trypanosomosis. Treatment was given with diminazene aceturate and 20% oxytetracycline parenterally. Examination of the blood film after therapy showed no parasite that indicated complete recovery of the ox. Bovine trypanosomosis is a neglected protozoal disease that causes death in untreated cases and production loss. Its control can be achieved through the use of antitrypanosomal drugs. However, restrict the movement of sick animals, monitor distribution of the disease, control vectors, follow good husbandry, and treat affected animals is essential to control the disease effectively.

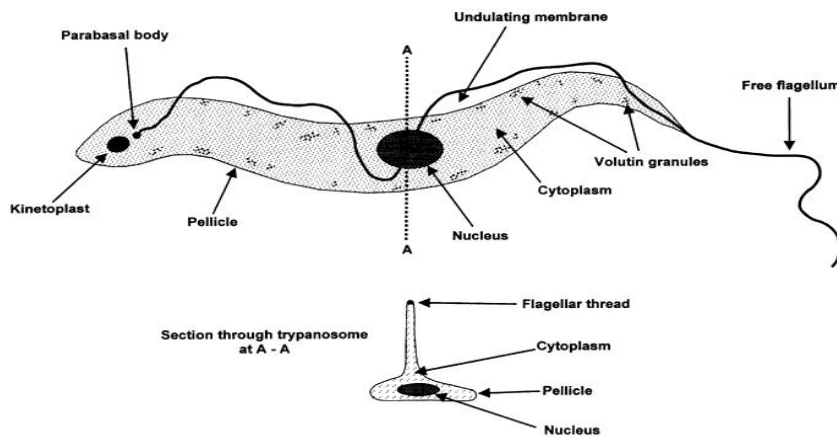
**Key words;** Ox, Trypanosomosis, Tsetse fly

#### Introduction

Trypanosomosis is a fatal, debilitating and complex protozoan disease of livestock and people, mostly transmitted by the tsetse fly in most parts of Africa. The disease causes major restraint to livestock productivity with severe socioeconomic consequences in which its impact vary with season and agro-ecologies in line with distribution of fly vectors (Auty *et al.*, 2015). Bovine trypanosomosis is widely distributed in Ethiopia which is caused by trypanosome parasite. Widespread nature and impact of the disease is due to distribution of tsetse flies, ability of trypanosomes to escape host defense and by their capacity to infect a large variety of other hosts (Waisa *et al.*, 2020; Tulu, 2019).

The disease is mainly caused by flagellated unicellular haemoparasites of trypanosome species (figure 33) (*Trypanosoma congolense*, *T. brucei* and *T. vivax*) which can be transmitted by various tsetse flies

(Glossina) Species. Trypanosomosis outside “tsetse belt” can be caused by mechanically biting flies (*T. vivax*). Cattle, sheep, goats and other domesticated and wild animals are infected by these parasites (Taylor *et al.*, 2015; Chau *et al.*, 2016). Trypanosomosis can cyclically (glossina species) and mechanically (other biting flies) transmitted by tsetse fly and other biting flies and additionally by iatrogenic transmission by unhygienic procedures and venereally through coitus. The disease mainly occurs in tsetse flies inhabited areas that infest many countries, mostly in Africa, where it is known as ‘Nagana’. It is usually transmitted through blood, lymph and other fluids of infected animals (Kargbo and Kuye, 2020; Bekuma, 2019).



**Figure 33:** Diagram of a trypanosome (<http://www.fao.org/3/X0413E/X0413E02.htm>).

The disease is characteristically acute or chronic, and the course is affected by malnutrition, concurrent infections and other stressors. Clinical signs appear usually within 1-4 weeks which are intermittent fever, anemia and weight loss but in cattle it has a chronic course with high mortality (Ahmed *et al.*, 2016). Major clinical signs consistent with bovine trypanosomosis are swaying and lagging, anaemia, weight and productivity loss, rough hair coat, lethargic, pale mucous membranes, swellings of visible superficial lymph nodes, chancre, fluctuating of body temperature, decreased fertility, emaciation due to inappetence and finally death due to congestive heart failure and nervous problems (Taylor *et al.*, 2015; Pereira *et al.*, 2018).

Bovine trypanosomosis can be diagnosed by clinical signs, history or presence of tsetse fly in the vicinity and laboratory investigations. Definitive parasitological diagnosis depends on demonstration of the trypanosome in blood samples by staining. Trypanosomosis can also be diagnosed by serological and PCR tests (Giordani *et al.*, 2016; Degneh *et al.*, 2017; Tylor *et al.*, 2015). Trypanosomosis with

fever, anaemia and emaciation can be differentially diagnosed from babesiosis, anaplasmosis, theileriosis, haemorrhagic septicaemia, malnutrition and helminthosis (Ramírez-Iglesias *et al.*, 2017; Sèsséya *et al.*, 2019). It can be treated with trypanocidal drugs if detected early. Therapeutic drugs for cattle include diminazene aceturate, homidium chloride and homidium bromide while prophylactic drugs for these animals include isometamidium, homidium chloride and bromide. However, the effectiveness of these drugs is now questionable following years of use, causing resistance and now various strains of trypanosomosis are occurring. At present, no field vaccine is available for bovine trypanosomiasis (Taylor *et al.*, 2015; Gumasta *et al.*, 2019).

The disease can cause significant economic losses by cattle mortality, production loss, drug purchase, salaries of the operators and loss of draft power of infected oxen. This impact is greatest in case of high challenge areas, in the absence of trypanotolerant breeds and in high prevalent of fly vectors that prevent the keeping of livestock (Sutherland *et al.*, 2017; Shaw *et al.*, 2015). Annual estimated losses for Ethiopia as a result of trypanosomosis is roughly \$200 million, in terms of mortality and morbidity in livestock excluding the costs included in controlling the disease (FAO, 2016; Gelaye, 2020).

Trypanosomosis in different animals can be controlled and prevented by using trypanotolerant animal breeds, chemotherapeutic and prophylactic drugs, eradicate tsetse flies and alteration of vegetation to make unsuitable for vectors (Mamoudou *et al.*, 2016). Control measures should be established as fast as possible without losing time by sending samples to a distant laboratory. Ruminants may gradually recover if the number of infected tsetse flies is low; however, stress like starvation and transportation can result in relapse (Semayat and Maireg, 2018; Bekuma, 2019). Therefore, this case report describes the clinical case of bovine trypanosomosis in ox and its management and treatment outcome.

#### Description of the case

A local breed ox with body weight of 260 kg was presented to MVC, Modjo, on March 28/2021 with main complaint of rough hair with characteristic upstanding appearance, becoming progressively thinner and listless, lagging behind the herd, loses interest in its surroundings and presence of minor wounds on the body. The ox has a history of transportation by car and on limb where it was bought somewhere from the market around the southern part of Oromia region (tsetse infested area). The owner also stated that the ox was managed semi-intensively and that multiple wounds at the rump and other body region may be due to birds pecking.

During physical and clinical examination, the ox was dull but responsive. The vital signs were within the normal range (body temperature of 38.6 °c, respiratory rate of 18 breaths/minute and heart rate of 60 beats/minute). Mucous membrane was pale with capillary refill time of more than 2 seconds. There were circumscribed wounds at the legs (right knee joint, ventral thoracic and around the thigh region) (figure 34). There were bilateral enlargement of prescapular and prefemoral lymph nodes during palpation. The EDDIE mobile App diagnosis resulted the case as trypanosomosis. Based on clinical findings, history and EEDIE App result, the case was tentatively diagnosed as bovine trypanosomosis which is differentially diagnosed from babesiosis, theileriosis and malnutrition.

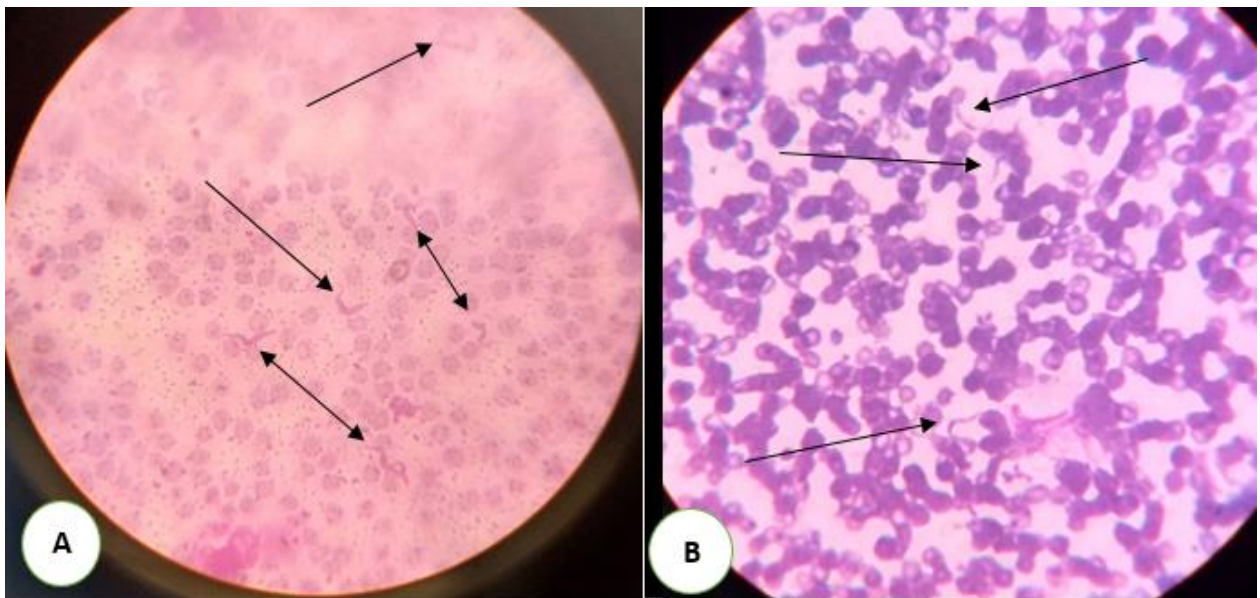


**Figure 34:** Picture of the ox suspected by trypanosomosis infection (the arrows indicate piercing by birds).

#### Laboratory investigation and its findings

Blood sample was taken from jugular and marginal ear vein of the ox and transported to Veterinary clinical pathology laboratory of AAU-CVMA for detection of parasites and packed cell volume (PCV) determination. Then, thin blood smear was prepared and the prepared blood smear was fixed by methanol and stained with a mixture of modified wrights (wrights-giemsa) stain (figure 35A) and giemsa stain alone (figure 35B). The smears were examined under a light microscope using x100 oil immersion objective lens to identify trypanosomes and trypanosome parasites were observed (figure 35). The PCV was determined by taking the blood sample directly into heparinised capillary tubes sealed at one end with crystal seal, and placed them to microhaematocrit centrifuge (at 12,000 rpm for 5 minutes). After centrifugation the result was read as 20% (normal reference values are 24-37) which

indicates anemic condition of the ox. Finally, based on history, clinical signs, EDDIE and laboratory results, the case was confirmed as bovine trypanosomosis.



**Figure 35:** Laboratory result of trypanosomosis suspected ox, (**A** indicates blood smear with modified wrights stain and **B**, showed giemsa stained results).

#### Case management and treatment outcome

The current case was managed and treated with antitrypanocidal drug, diminazene aceturate 2.36 grams (Kexing pharmaceuticals Co. Ltd., China) at a recommended dose of 3.5 mg/kg body weight intramuscularly every other day for two days and long-acting oxytetracycline (Hebei Huarum Co., Ltd., China) single injection was also given with a dose of 20mg/kg body weight intramuscularly as prophylaxis for other bacterial infections. Additionally, the minor wound on the animal due to the birds piercing was disinfected and dressed with savlone and tincture of iodine. The owner was advised to provide good feeding and rest until recovery. After treatment and management with follow-up, the ox has fully recovered from the infection completely after two months (36 below).



**Figure 36:** Recovered ox from trypanosomosis after two months.

#### Discussion

(Auty *et al.*, 2015; Kelvin *et al.*, 2019) have indicated that there are various factors which contribute to the chance of occurrence and reinfection of bovine trypanosomosis. These factors include nutritional deficiency, fly vector migration, continuous animal movements, commercialization of animals in the absence of adequate sanitary control, nature of the agents (antigenic variation), host immunity, stress factors like transportation, work overload (drought) and others which play role of circulation of the disease in tsetse infested and tsetse free areas. This agrees with the current case report that the ox has a history of the movement from prevalent disease areas or getting an infection due to fly vector migration, which indicates the prevalence of the disease outside the cyclical vectors.

The epidemiology of trypanosomosis is highly dependent on the vector, parasite and host factors. The degree of risk to which domestic animals are exposed to the disease depends on tsetse fly species and density, infection rate, trypanosomes species and strain, flies preference for feeding and source of infection. Most of the species of trypanosomes are limited in distribution to low land areas which are the home of cyclical vectors. However, mechanically transmitted trypanosomes species have a diverse distribution. The wide-spread of these species is due to their adaptation to mechanical transmission by biting flies in areas outside tsetse fly belt which is consistent with the current case report and other findings demonstrated by (Osório *et al.*, 2018; Leta *et al.*, 2016; Wereda and Valley, 2019).

Even though, animal trypanosomosis have no its own pathognomonic signs, it can be diagnosed by history, laboratory findings and some of the clinical signs like swelling of superficial and visible lymph nodes, anemia, rough hair coat, loss of condition (production and emaciation), chancre and oedema (Ramírez-Iglesias *et al.*, 2017; Giordani *et al.*, 2016). These signs are in agreement with the clinical signs of the current case. The golden diagnostic test is direct parasitological detection using microscopic examination of the blood smears (Pereira *et al.*, 2018). The current case was diagnosed by clinical signs, history, EDDIE App-based diagnosis and laboratory detection of the blood sample by thin smear with giemsa and wrights stain resulting presence of trypanosome parasite on the smear. This agrees with the diagnostic approach and management techniques of trypanosomosis in cattle in endemic areas conducted by (Edget and Meseret, 2019; Lean, 2018; Sèsséya *et al.*, 2019).

Trypanosomosis can only be treated therapeutically either by chemotherapy or chemoprophylaxis by antitrypanosomal drugs. Diminazene aceturate provides shorter protection period about 2 weeks while isometamidium provides longer protection period, which is up to 4 months (Gumasta *et al.*, 2019; Reis *et al.*, 2019). For the current case, therapy was started on the day of first visit with diminazene aceturate since isomethamidium was not available and the case was not common in the vicinity. This medication was given for two days for every another day following the first injection to establish high plasma concentration and longer plasma half-life in the animal. This has eliminated the trypanosomes as checked after recovery. Other supportive therapies like disinfecting the wound and long-acting oxytetracycline injection to avoid bacterial complications were also used. This protocol is in agreement with the treatment and management of trypanosomosis by (Taylor *et al.*, 2015; Jesse *et al.*, 2016; Gumasta *et al.*, 2019).

In conclusion, bovine trypanosomosis is a neglected protozoal disease that causes death in untreated cases and production loss. Its control can be achieved through the use of antitrypanosomal drugs. However, restrict the movement of sick animals, monitor distribution of the disease, control vectors, follow good husbandry, and treat affected animals is essential to control the disease effectively.

#### 3.2.4. Mange (*Allergic dermatitis*); a case of a calf and its treatment outcome

##### Abstract

Mange is a contagious parasitic dermatitis of animals caused by many species of microscopic mites and characterized by itching, alopecia, crusts, thickening and folding of the skin. A three month-old

local breed young calf with major complaints of reduced well-being, scratching, hair loss, crusts, and scabs on the skin was presented to MVC, Modjo, on January 03/2021. General physical and clinical examination revealed that vital parameters have shown the value within the normal range with a mildly increased respiratory rate. The calf had good appetite, however, there was presence of generalized skin lesions seen on the head, neck, ventral abdomen, fore and hind limbs and tail region characterized by crusting, scaling, thickening and corrugation of skin, scab formation, alopecia and intense itching. EDDIE App-based diagnosis and microscopic examination of deep skin scrapings indicated mange and presence of mites respectively. This case was treated using ivermectin parenterally and amitraz topically, which provided effective outcome and recovery after two months. Mange is an economically significant disease of livestock characterized by itching, localized alopecia, scabs, crusts and wrinkling of the skin, however, it can be treated and controlled by effective parenteral and topical acaricides and proper husbandry practices if detected early.

**Key words;** *Calf, Mite, Mange*

## Introduction

Mange, which has been considered as one of the most common parasitic infestations is the collective name for allergic dermatitis caused by mites and occurs worldwide by attacking all ages and breeds of cattle. It adversely influences animal productivity causing high economic losses in wool, skin and hide and production loss and poses a risk to human health as zoonosis, especially sarcoptic mites causing scabies. Animals with long hair and poor grooming or husbandry practice are highly susceptible to the disease (Mesarič and Zadnik, 2019; Abed *et al.*, 2020).

The disease is caused by obligate ectoparasites that feed mainly on lymph, blood and skin secretions from the skin surface or damaged skin. There are two types of mange mites; burrowing (*Sarcoptes scabiei* and *Demodex bovis*) mites which affect hair follicles and associated glands and non-burrowing mites (*Chorioptes bovis* and *Psoroptes ovis*) (Elsheikha and Wright, 2015). The mites are transmitted mainly by direct contact and animals can pick them from immediate environment or fomites where they can survive for about two weeks in the environment. Transmission and development of the disease is common during winter season (cold weather) and normally seen in adult confined cattle (Ashagre *et al.*, 2016). The mites have a life cycle of (egg, larvae, nymph and adult) about 2-3 weeks from egg to adult, after which the adult female lay eggs for up to 40-60 days (Taylor *et al.*, 2016; Chen *et al.*, 2021).

Lesions caused by mites start from the predilection sites on the legs (inner thigh), head, neck (brisket), back (wither), shoulders, udder, root of the tail and other body parts depending on the type of mite affecting the animals and can spread to other parts of the body (Hamel *et al.*, 2015). The clinical signs include restlessness, reduced well-being, biting and rubbing the affected parts, irritation and scratching (pruritus) on the standing object that leads to inflammation and allergic reactions, exudation with crusts and scabs formation, massive hair loss, progressive thickening and hardening of the skin with building of large folds and loss of condition and production in untreated animals. These injuries due to mites make the animal to become infected with secondary bacterial infection leading to death (Asmare *et al.*, 2018; Chen *et al.*, 2021). The disease can be diagnosed by deep skin scrapings for microscope examination of the mites, skin biopsy or response to therapy. The differential diagnosis of mange mite can be dermatophytosis, photosensitization and dermatophilosis (Taylor *et al.*, 2016).

Treatment of mange in herds is achieved effectively with macrocyclic lactones (ivermectins and milbemycins) and synthetic pyrethroids which are effective against most species and stages of mite causing mange. Additionally, other topical application of acaricides (sprays, dips or pour-ons) will also give a better outcome. It can be controlled by the use of injectable and topical products along with proper management (hygiene, feeding, cleaning, isolating or avoid close contact), especially during the winter months (Rehbein *et al.*, 2016; Visser *et al.*, 2013). The disease causes huge economic losses in tropical and subtropical countries including Ethiopia by reducing the productivity of animals, especially in skin and hide. Currently, the disease has no available vaccines, repellents, biological control methods and traps; so it can be deadly for young cattle left untreated ((Espinosa *et al.*, 2020; Azene *et al.*, 2020). Hence, the current case report describes the case of mange in a calf and its treatment outcome.

#### Description of the case

A three month-old local breed young calf with major complaints of reduced well-being, scratching, hair loss, crusts, and scabs on the skin was presented to MVC, Modjo, on January 03/2021. General physical examination revealed that the vital parameters have shown the value with in the normal range (39.1 °c of body temperature, 84 beats/minute of heart rate) with a mildly increased respiratory rate (32 breaths/minute) and normal palpable lymph nodes and pinkish mucus membrane. Clinical examination showed that the animal had a good appetite but there was presence of generalized skin lesions seen on the head, neck (dewlap), ventral abdomen, fore and hind limbs and tail region characterized by crusting,

scaling or lichenification, thickening, wrinkling and corrugation of the skin, scab formation, localized alopecia and intense itching (figure 37). A tentative diagnosis of mange was made by the clinician and EDDIE App-based diagnosis. Therefore, based on history, clinical signs and EDDIE App-based result, the case was tentatively diagnosed as mange which is differentially diagnosed from dermatophilosis and dermatophytosis.



**Figure 37:** Picture of the calf suspected by mange (arrows indicate lesions in different sites).

#### Laboratory investigation and its findings

Following general physical and clinical examination of the calf, deep skin scraping was taken by petri plates from edges of the clinical cutaneous lesions after hairs were clipped and the skin was sterilized from different body parts. The sample was immediately sent to VTH multipurpose laboratory of AAU-CVMA, Bishoftu, for further processing and examination. Then the skin scraping was mixed with a small amount of 10% potassium hydroxide (KOH) solution and left to stand for 30 minutes until the skin particles have partly disintegrated. Examination under microscopic, gave a result of mite as indicated in figure 38 below. Simultaneously, the skin scraping was minced and placed on microscope slides for Gram and Giemsa staining for the detection of dermatophilosis and fungal infections but this indicated a negative result. Therefore, based on history, clinical signs, EEDIE App-based and laboratory results, the case was confirmed as mange.



**Figure 38:** Laboratory result of the sample taken from the calf suspected by mange.

#### Case management and treatment outcome

The case was medically managed with ivermectin (Hebei Huarum pharmacy Co., Ltd., China) with a recommended dose of 0.2mg/kg body weight subcutaneously once a day for three days with an interval of first, fifth and tenth day therapy and amitraz (Shenzhen king quenson industry Co., Ltd, China) was topically applied over the body of the calf at the dose of 4ml in one liter of water. Long-acting oxytetracycline (Gongyi pharmaceutical Co., Ltd, China) at a dose of 20mg/kg was also used for the control of secondary bacterial infection. The owner was advised to isolate the calf from other animals by providing proper feeding, keeping hygiene and other husbandry practices such as spraying the bedding of animals with acaricide. After this treatment and feeding management, the mites recede spontaneously from the calf, and the calf showed better clinical improvement and recovery from infestation after two months as indicated in figure 39 below.



**Figure 39:** Status of the calf after one (A) and two (B) months respectively.

#### Discussion

There are numerous types and number of ectoparasites globally infesting livestock, and more importantly affect production and performance of animals by causing disturbance and self-wounding of cattle leading to limited time spent for grazing and hence, adversely affects production of livestock in many regions. Among the various ectoparasites, mites are highly prevalent in the tropical countries like Ethiopia where favorable environmental conditions together with poor management could severely affect the production of animals. Mites cause Mange which is the major parasitic cause of skin diseases known by causing downgrading and deteriorating the quality of skin and hide with reduced productivity of the animals (Kumar *et al.*, 2020; Azene *et al.*, 2020; Ahmed *et al.*, 2020) .

Different researches and their findings in different time indicated that the disease is highly prevalent in Ethiopia showing that the disease is a growing threat for the production of livestock in the country. The overall prevalence in cattle around Mekele and Adigrat was 19.8% (Ashagre *et al.*, 2016), it was 10.9% in Wolaita in cattle (Sitotaw *et al.*, 2018), 10.7% was prevalent in South Achefer (Agumas *et al.*, 2015), it was also recored 4.2 % in sheep and 5.34 % in goats respectively in Beadle (Yomifan *et al.*, 2019), another finding also indicates 4.68% in small ruminants in and around Jimma town by (Fentahun *et al.*, 2012) and others. This indicates that the disease is highly prevalent in different parts of Ethiopia by causing huge losses to the farmers and the country as well.

From the current case report, the infestation was reported in a young calf of about three months of age with good appetite but reduced well-being and body condition and other clinical presentations of scratching, localized alopecia, thickened and wrinkled skin with scabs, crust, cracks and fissures on most parts the body of the calf. Lesions result directly from mechanical damage due to mites when they feed and move and from irritating secretions from mites. Additionally, inflammation is produced due to foreign antigens from mites as a result of immune-mediated hypersensitivity. Thus intense pruritis (itching) is a clinical manifestation of irritation and inflammation in which the animal responds it by rubbing or self-mutilation that interferes feed intake with subsequent decreased weight gain and skin and hide quality. This finding and case report is in line with the case reports of others which showed that the infestation of mange is often seen in young, unkempt, undernourished and immunocompromised animals (Grafofer *et al.*, 2018; Kottadamane *et al.*, 2016; Nwoha, 2011; Chen *et al.*, 2021).

After a through diagnosis of the calf with history, physical and clinical examination and laboratory confirmation of the case by microscopic identification of the mite from deep skin scraps as mange, the treatment and management approach selected and used was parenteral therapy of ivermectin through subcutaneous route and topical application of amitraz by spraying on the whole body parts of the calf along with forwarding recommendations to the owner to follow and practice proper husbandry practices; so that the calf showed a satisfactory clinical improvement and recovery from the infestation with relatively short period of time. This agrees with the findings and treatment protocols of (Rehbein *et al.*, 2016; Moroni *et al.*, 2020 ; Currier *et al.*, 2011; Taylor *et al.*, 2016).

In conclusion, mange is an economically significant disease of livestock characterized by itching, localized alopecia, scabs, crusts and wrinkling of the skin, however, it can be treated and controlled by effective parenteral and topical acaricides and proper husbandry practices if detected early.

### 3.2.5. Bovine fasciolosis; a case of a cow

#### Abstract

Fasciolosis (liver fluke) is one of the most common economically important and prevalent parasitic infections of ruminant animals globally. An old boran breed cow with 260 kg body weight from an extensive management system was presented to VTH of AAU-CVMA on December 21/2020 with major complaints of a progressively developed submandibular swelling under the neck especially after

grazing, reduced body condition, grazing on marshy pasture that was used for irrigation with no deworming for about four months. Up-on physical and clinical examination, it showed rough hair coat, depression, yellowish mucus membrane, with normal body vital parameters and palpable lymph nodes size. The EDDIE App and fecal sedimentation technique with methylene blue stain revealed fasciolosis and yellowish operculated parasitic eggs respectively. This case was treated with triclabendazole that provided a fully recovered cow after a month. Fasciolosis is a widespread parasitic disease in swampy areas affecting the health and productivity of animals. It can be controlled and prevented by strategic anthelmintic treatment with appropriate flukicidal drugs after the end of dry and rainy seasons and minimized pasture contamination thus interrupting the life cycle of the parasite.

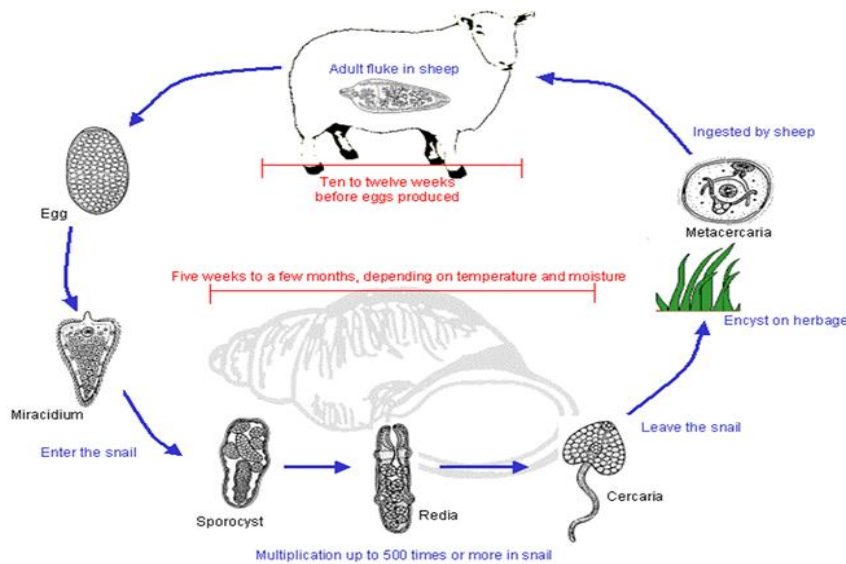
**Key words;** *Bottle jaw, Cow, Fasciolosis, Sedimentation*

## Introduction

Fasciolosis, caused by trematode, *Fasciola species* is one of the most common and prevalent helminthes infections of livestock and human in different parts of the world. The disease is the major cause of considerable economic losses in cattle, sheep and goat industry, mainly through mortality, liver condemnation, reduced milk and meat production and expenditure for anthelmintics (Elshraway and Mahmoud, 2017). Bovine fasciolosis is one of the most important parasitic diseases because of its substantial damage and economic losses that hamper livestock production in Ethiopia. It is a serious disease of grazing animals in humid and sub humid zones (Arbabi *et al.*, 2018; FAO, 2020).

The disease is caused by the genus fasciola, commonly known as liver flukes. The two most common species that causes fasciolosis are *Fasciola hepatica* and *Fasciola gigantica*. *F. hepatica* has a worldwide distribution while *F. gigantica* is found primarily in the tropical regions and most continents. This disease affects large variety of animals and show infection rates that may reach 90% in some areas. It occurs mainly in temperate regions where climate favors and facilitate the development of the organism and intermediate host, the snail of the genus *Lymnaea* (Hamed *et al.*, 2014; Girma and Delelegn, 2019). The occurrence of the disease is fundamentally linked to the mollusk of the genus lymnaea species presence, which acts as the agent's intermediate host, establishing the infective stage of cercaria. Additionally low elevation areas, presence of flooded and wetlands, irrigated areas and extensive livestock breeding are factors that contribute to the maintenance of the mollusk and to the spread of fascioliasis (Aleixo *et al.*, 2015).

Transmission or life cycle of fasciolosis infection is depending on the presence of intermediate “lymnaea snail” host and final host that include ruminants, equidae and swine as indicated in figure 40 below. This snail host commonly presents in high density during rainfall period annually and/or in highly moist pastures soil (Abraham and Jude 2014). The disease is found in vast water lodged and swampy grazing field condition projected to be ideal for the propagation and maintenance of high prevalence of fasciolosis. This disease is widely distributed in areas where cattle are raised and there is a niche for *Lymnaeid* snail (Eman *et al.*, 2016; Kusumarini *et al.*, 2020).



**Figure 40:** The life cycle of fasciolosis, which was accessed on December 22/2021 with the web page address at; <https://www.scops.org.uk/internal-parasites/liver-fluke/lifecycle/>.

The main clinical signs of the disease are gradual reduction of weight, weakness, anemia, jaundice and subcutaneous edema particularly in submandibular region and abdomen and additionally decreased weight gain and milk yield. The disease is usually characterized by acute, sub-acute or chronic inflammation of the liver and bile ducts, accompanied by sub-mandibular oedema, anaemia, anorexia, general intoxication and death. In cattle, chronic form of the disease is more common and it occurs when the parasite reaches the hepatic bile duct. Animals have pale mucus membranes, become emaciated and typically develop “bottle jaw” due to edema under the jaw. (FAO, 2020; Magaji *et al.*, 2014; Nyirenda *et al.*, 2019). Diagnosis is based on clinical signs, grazing history, snail habitats, seasonal occurrence, laboratory examination of faeces and post-mortem examination. The differential diagnosis of fasciolosis are haemonchosis, strongylosis and abscess (Eman *et al.*, 2016; Tak *et al.*, 2014).

Fasciolosis control programmes must be performed with preventive treatments under strategic program based on intermediate host life cycle. Most programmes rely heavily on flukicidal treatments that depends on level of fluke challenge, time of year, management and husbandry systems. Additionally history, topography, prevailing weather, draining swampy areas and intensive management system should be undertaken. But the indication to drain locations in endemic areas can be difficult when these consists of vast irrigation grasslands for agricultural use (Festus *et al.*, 2017; Constable *et al.* , 2017). In Ethiopia bovine and ovine fasciolosis losses were estimated at 350 and 48.4 million ETB per year due to decreased productivity respectively (Zewde *et al.*, 2019; Yitagezu *et al.*, 2015). In addition, fascioliasis is now recognized as an emerging human disease: the world health organization (WHO) has estimated that 2.4 million people are infected with fasciola, and a further 180 million are at risk of infection (WHO 2020; Kalu, 2016). Therefore, the present case report describes fasciolosis in a cow and its management outcome.

#### Description of the case

An old boran breed cow with 260 kg body weight from an extensive management system was presented to VTH of AAU-CVMA on December 21/2020 with major complaints of a progressively developed submandibular swelling under the neck especially after grazing, reduced body condition and milk yield, history of grazing on swampy pasture that was used for irrigation and no regular deworming for about four months. Up-on physical and clinical examination when the cow was evaluated, it showed rough hair coat, depression, anemia or ill thrift, yellowish mucus membrane, with body temperature of 37.8 °c, heart rate of 60 beats/minute, respiratory rate of 28 breaths/minute, ruminal motility of 2 times/second and palpable lymph nodes were in their normal size but submandibular swelling (figure 41). The EDDIE App-based result revealed the case as fasciolosis. Based on history, clinical findings and EDDIE result, the case was tentatively diagnosed as bovine fasciolosis which is differentially diagnosed from haemonchosis, oedema, abscess and haematoma.



**Figure 41:** Picture of a cow with bottled jaw indicating bovine fasciolosis.

#### Laboratory investigation and its findings

Fresh fecal sample was taken directly from the rectum of the cow and immediately transported to veterinary parasitology laboratory of AAU-CVMA. Feecal floatation and sedimentation techniques were demonstrated simultaneously. Under 40X microscopic magnification, an ellipsoid yellowish operculated egg indicating fasciola was observed in sedimentation technique stained with methylene blue (figure 42 below) but in flotation no egg was observed under microscopic examination. Based on the history, clinical signs observed, EDDIE App result and laboratory finding, the case was finally diagnosed as bovine fasciolosis.



**Figure 42:** Fasciola egg observed under microscope from fecal sedimentation.

## Case management and treatment outcome

The current case was treated with triclabendazole (Glopoa exports Pvt., Ltd, India) 12 mg/kg body weight orally stat repeated after a week and long-acting oxytetracycline (Gongyi pharmaceutical Co., Ltd, China) at a dose of 1ml/10kg intramuscularly stat as a prophylaxis measure and to prevent for other secondary bacterial complications. The owner was advised to keep his animals from grazing on such marshy areas and deworming them regularly. The cow has completely recovered from the infection after one month as indicated in figure 43 below.



**Figure 43:** Recovered cow from fasciolosis after a month.

## Discussion

(Olsen *et al.*, 2015; Takeuchi-storm *et al.*, 2017) emphasized on their findings that even at a dry season, some places are still partially wet, supporting animal grazing in marshy areas. In these places, the metacercariae can keep their viability with its consequent passive ingestion and thus leads to increasing disease prevalence. This finding is in agreement with the present case report in which the cow grazed on wet and irrigated land for searching of good herbage that predisposed it for infection by fasciolosis.

In this case report, the clinical signs observed, grazing history of the cow from swampy and irrigated land, the management system followed (extensive) and the widespread prevalence of parasitic diseases in the area affecting the health and productivity of animals indicate the presence of fasciolosis. This agrees with the findings conducted by (Tulu and Gebeyehu, 2018; Eman *et al.*, 2016; Aragaw and Sheferaw, 2012) on the prevalence and associated risk factors of fasciolosis. Elsewhere, numerous

findings for the definitive diagnosis of fasciolosis were made based on fecal sedimentation techniques on parasitological laboratories for microscopic magnification and observation of yellowish to bright oporculated fasciola eggs (Gojam and Tulu, 2018; Kusumarini *et al.*, 2020; Berhe *et al.*, 2017), which agrees with the findings in the present study.

Bovine fasciolosis is generally considered as a subclinical disease with economic losses, primarily resulting from decreased productivity (Yatswako and Bida, 2017; Arbabi *et al.*, 2018). Removal of flukes from infected animals by selecting a drug highly effective against all stages of the parasite provides an added health benefit, but preventing pasture contamination of infective stages and the consequent transmission to cattle is the basis for most treatment recommendations. So, in the present case report triclabendazole was selected for treatment purpose since it is considered as the most common drug due to its high efficacy against adult as well juvenile flukes to interfere the parasite's life cycle and epidemiology. This is in line with (Adrien *et al.*, 2013; Constable *et al.*, 2017).

In conclusion, fasciolosis is a widespread parasitic disease in swampy areas affecting the health and productivity of animals. It can be controlled and prevented by strategic anthelmintic treatment with appropriate flukicidal drugs after the end of dry and rainy seasons, and minimized pasture contamination thus interrupting the life cycle of the parasite.

### **3.3. Case reports on Viral Diseases of Livestock**

#### *3.3.1. Newcastle Disease; Its postmortem and other diagnostic findings in hens*

##### **Abstract**

New castle disease is highly contagious, commonly occurring and overwhelming viral disease affecting poultry and significantly cause global socioeconomic impact. Four hens were referred and presented to VTH of AAU-CVMA, Bishoftu, on February 08/2020 with major complaints of occurrence of a disease and death of hens in his private poultry farm around Modjo town. The owner also complained that most of the hens showed symptoms of incoordination, unable to fed, depression, weakness, greenish watery diarrhea, followed by sudden death. Up-on clinical examination, lying down, swelling of face, twisting of neck, paralysis of legs, greenish diarrhea and arched position of the hens' body were observed. During postmortem inspection, marked congestion of trachea with hemorrhages, pinpoint hemorrhages on proventriculus, enlarged and hemorrhagic caecal tonsils, hemorrhagic lesions in the intestinal wall

and inflamed cloudy and congested air sacs were observed. EDDIE App based smart phone diagnosis was not used in this case, since it has no data for poultry diseases. Cloacal and tracheal swab samples showed a positive result for NCDV. Newcastle disease is one of the most economically important poultry disease characterized by high morbidity, mortality, and spreading nature. However, rapid and consistent detection of the disease with isolation of suspected hens, proper hygiene, vaccination and strict biosecurity measures can reduce the losses associated with this disease.

**Keywords;** *Hens. Newcastle disease, Postmortem examination*

## Introduction

Newcastle disease is one of the most commonly occurring, overwhelming, and highly contagious viral infections that affect many species of domestic and wild birds worldwide to varying degrees. It considerably hampers the global poultry industry of the world. Because of its huge socioeconomic importance and potential to rapidly spread to naive birds in the neighborhood, it is included among the list of avian diseases that must be notified to the OIE immediately upon recognition. In the poultry industry, it remains a constant threat and is a limiting disease for producers of poultry globally. The variety of clinical presentations and the emergence and spread of new genetic variants make recognition and diagnosis challenging (OIE, 2013; Bello *et al.*, 2018; Abah *et al.*, 2020).

Newcastle disease (ND) is a viral disease of poultry caused by a single-strand, non-segmented, negative-sense RNA virus which is known as *Newcastle disease virus (NCDV)* in the genus *Avianorthonavulavirus1 (AOAV-1)* in the family *Paramyxoviridae* (Dimitrov *et al.*, 2019). There are 9 serotypes of *Avianorthonavulavirus*, but all isolates of Newcastle disease virus (NDV) belong to serotype 1, therefore NDV is synonymous with AOAV-1. Although all NDV isolates belong to a single serotype (AOAV-1), there is great genetic variability among different strains. Based upon phylogenetic reconstruction, NDV can be divided into 2 classes (I and II), each of those respectively subdivided into 9 and 10 genotypes (Sutton *et al.*, 2019; Miller *et al.*, 2010; Quin *et al.*, 2016).

Newcastel disease is transmitted most often by direct contact with diseased or carrier birds that may shed the virus contaminating the environment. It can also transmitted by contaminated food, water, equipment, and human clothing with feces and respiratory discharges. ND viruses can survive for several weeks in the environment, especially in cool weather and shed during the incubation period and

for a short time during recovery. Other wild birds have also been shown to have caused outbreaks in domestic poultry (Dimitrov *et al.*, 2019; Abdisa and Tagesu, 2017; Absalón *et al.*, 2019).

Clinical signs of NDV vary widely, and are dependent on factors like the pathotype, host species, age and co-infection with other organisms, environmental stress and immune status. Different strains of NDV are distinguished into five pathotypes that cause clinical signs. Velogenic viruses are responsible for acute lethal infection showing frequently haemorrhagic lesions of the digestive tract of dead birds; Neurotropic velogenic viruses cause acute neurological signs and often-high mortality which follows respiratory distress; Lesogenic viruses produce moderate respiratory disease with high mortality only in young birds and Lentogenic viruses cause mild infections of respiratory tract and asymptomatic enteric signs (Quin *et al.*, 2016). In addition, aggravating factors like immune depression, and concurrent infections may result in clinical signs induced by milder strains to resemble those of more virulent strains in the field (OIE, 2013; Sutton *et al.*, 2019).

Generally, NCD may involve signs of depression, greenish diarrhea, prostration, edema of the head and wattles. In the velogenic one, clinical signs often begin with listlessness, increased respiration ending with death. Diarrhoea is frequently seen. Surviving birds may develop nervous signs such as muscular tremors, paralysis and torticollis (Senne *et al.*, 2005; Bhaiyat *et al.*, 1994; OIE, 2013). In neurotropic velogenic type, the clinical signs are marked by severe respiratory disease shortly followed by neurological signs. With all pathotypes of ND, egg production decreases dramatically and sometimes leading to complete egg laying cessation and death. Virulent ND strains may replicate in vaccinated birds, but the clinical signs will be greatly diminished depending on the antibody level (Hana *et al.*, 2018).

Avianorthoaavulavirus1 infections are usually diagnosed by clinical signs, virus isolation, inoculating from embryonated chicken egg, PCR, haemagglutination inhibition, serology in non-vaccinating countries (WOAH, 2012; Yune and Abdela, 2017). The prompt recognition of highly contagious OIE notifiable diseases like ND or AI and differentiation from other viral infections of poultry, causing similar clinical signs, such as gumboro disease is essential for the implementation of appropriate control measures and to limit economic losses (Murree *et al.*, 2016). There is no treatment for Newcastle disease, although treatment with antibiotics reduces secondary infections. Appropriate vaccination with live attenuated or inactivated vaccine is the only consistent control technique. However, under field conditions vaccination alone is not sufficient to control the disease. It must

therefore be accompanied by good hygiene, management and biosecurity procedures to reduce the losses ( Ban-Bo, 2013; Sharif *et al.*, 2014). Thus, the current case report describes the case of Newcastle disease and its postmortem and other diagnostic findings.

#### Description of the case

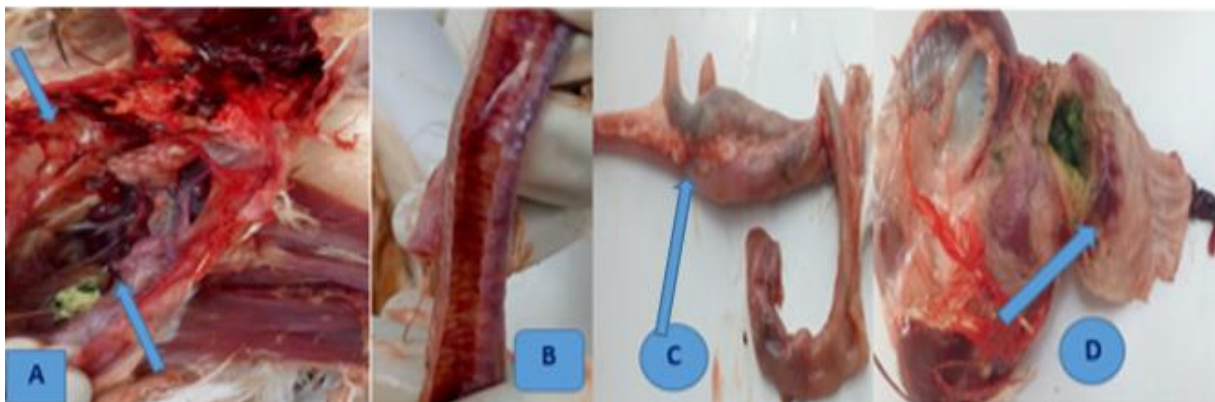
Four hens were referred from MVC and presented to VTH of AAU-CVMA, Bishoftu, on February 08/2020 with major complaints of occurrence of a disease and death of some of the hens in one of privately owned poultry farm around Modgo town. The owner also complained that, the hens first showed symptoms of incoordination, unable to fed, greenish watery diarrhea, depression, weakness followed by sudden death of some of his hens and some of the hens are left in the farm showing similar clinical signs. Based on clinical examination, lying down, swelling of the face, twisting of the neck and greenish diarrhea, paralysis of legs and arched position of the hens' body were observed (figure 44 below). EDDIE App-based diagnosis was not used in this case report because it didn't work for the diagnosis of poultry diseases. Based on history, occurrence of an outbreak and typical clinical signs, the case was tentatively diagnosed as Newcastle disease which is differentially diagnosed from mareks disease, avian influenza and gumbaro disease.



**Figure 44:** Pictures of suspected hens with Newcastle disease (greenish diarrhea and torticollis).

## Postmortem examination of the hens

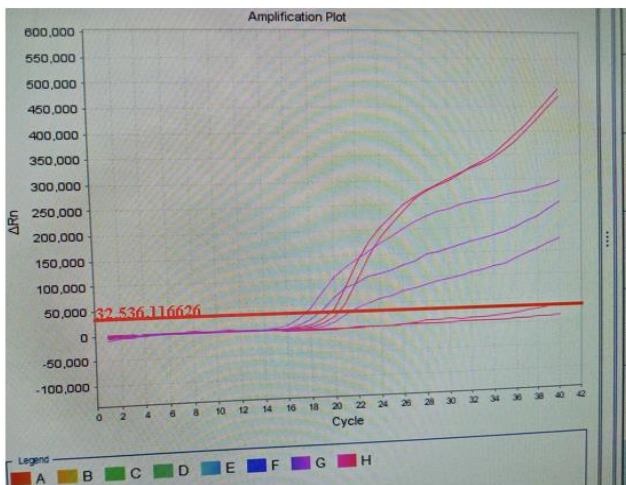
The hens were sent to AAU-CVMA's postmortem room for postmortem examination after the consensus of the owner that the result will be reported to him and he was advised to isolate healthy hens from suspected one and should follow hygienic precautions and early vaccination of the rest of the hens. During postmortem examination pinpoint haemorrhages on the tips of glands in the proventriculus, enlarged and haemorrhagic caecal tonsils, haemorrhagic lesions in the intestinal wall (in the lymphoid aggregates) and marked congestion of trachea with haemorrhages were observed. The air sacs appeared inflamed cloudy and congested that contained cheesy (caseous) material. These postmortem findings indicate the pathological indications of Newcastle disease (figure 45).



**Figure 45:** Pathological changes of hens due to NCD at post-mortem examination (**A**, indicates greenish GIT content with other hemorrhagic signs, **B**, indicates hemorrhagic trachea, and **C**, enlarged caecal tonsils and **D**, hemorrhagic proventriculus).

## Laboratory investigation and its findings

Cloacal swab from two hens and tracheal tissue (during postmortem) samples were collected with sterile swabs and directly placed into a screw capped cryovial tubes that contain viral transport media (VTM). Then, transported to National animal health diagnostic and investigation center (NAHDIC), Sebeta, Ethiopia for confirmation of the case. The laboratory result was positive for New castle disease by real time PCR for both samples (figure 46). Therefore, based on history, clinical signs, postmortem and laboratory results, the case was finally diagnosed as New Castle disease.



**Figure 46:** Picture of laboratory result (rtPCR) of NCD suspected hens (the pink/ purple line indicates the positive result of hens while the red one indicates positive and negative control).

## Discussion

Newcastle disease is the most economically important contagious poultry disease, affecting many domestic and wild avian species characterized by rapid spreading and mass mortality and can be transmitted to humans which is caused by Avian orthoavulavirus 1. This disease has been classified as a notifiable diseases list of terrestrial animals that causes huge socioeconomic impact (Dimitrov *et al.*, 2019; OIE, 2013). This agrees with the current outbreak of Newcastle disease, in which the owner of the farm has lost many hens and economic gain from egg due to death and disease of these hens and he is frustrating on the future consequences regarding his farm and economy.

In this case report, the clinical signs observed, occurrence of outbreak of the disease, typical postmortem examination and laboratory findings indicated that the case is Newcastle disease, but the smart phone application based diagnosis evaluation was not used since the application was not encoded with relevant data for diagnosis of poultry diseases. The clinical signs presented from the current case report were in agreement with the research conducted by (Messai *et al.*, 2019; Hasan *et al.*, 2010). Then, the hens were passed for postmortem examination for more detail diagnosis for better finding and confirmation of the case.

During postmortem examination, the findings observed in the current case report were marked congestion of trachea with haemorrhages and inflamed cloudy/congested air sacs, pinpoint haemorrhages on the tips of the glands in the proventriculus, enlarged and haemorrhagic caecal tonsils,

haemorrhagic lesions in the intestinal wall, and these findings were in agreement with (Ekou *et al.*, 2014) in which the postmortem examination revealed the case as the Newcastle disease. In conclusion, Newcastle disease is one of the most economically important poultry disease characterized by high rate of morbidity, mortality and spreading nature. However, rapid and consistent detection of the disease with isolation of suspected hens, proper hygiene, vaccination and strict biosecurity measures can reduce the losses associated with this disease in poultry farms.

### *3.3.2. Parvoviral infection in a puppy; its treatment outcome with combined antibiotic and supportive therapy*

#### Abstract

Canine parvoviral disease is one of the most common infectious and highly contagious acute enteritis in unvaccinated dogs younger than six months. In this case study a five-months-old male puppy was presented to VTH of AAU-CVMA, Bishoftu, with chief complains of a puppy that was normally alert and playful, becomes suddenly lethargic and depressed 3 days before presentation coupled with loss of appetite, subsequent vomiting and diarrhea one day ago before clinical presentation. The puppy later voided bloody and projectile foul-smelling diarrhea. It showed frequent vomition and diarrhea with retching and straining, prostration and isolating it self. Fecal sample was negative for parasitic infection. EDDIE App-based diagnosis was not used in this case, since it has no data for pet anima diseases. The case was tentatively diagnosed as canine parvovirus disease based on history, age and observed clinical signs. It was successfully recovered following antibiotic, fluid, multivitamin and antiemetic therapy. Therefore, the case can be cured if treated promptly and aggressively with appropriate drug accompanied by supportive therapy. It can be prevented and controlled by reducing stress, regular vaccination and deworming, and routine cleaning and disinfection of pets bedding.

**Keywords;** *Canine parvovirus type 2, Diarrhea and Vomiting, Puppy*

#### Introduction

Canine Parvovirus disease (CPD) is one of the most common infectious diseases in unvaccinated dogs younger than six months and caused by canine parvovirus type 2 (CPV-2). It causes a highly contagious acute enteritis with increased morbidity and mortality and very low survival rates in untreated canines. Although severe clinical disease typically occurs in dogs younger than 6 months of

age, adults with insufficient immunity may potentially be affected (Franzo *et al.*, 2019). CPV-2, the etiologic agent of acute hemorrhagic enteritis and myocarditis in canines, is one of the most pathogenic viruses. It causes a highly contagious and often fatal disease (Nandi and Kumar, 2010; Mccaw and Hoskins, 2006; Odueko, 2019).

‘Parvo’ means small (Latin), parvoviruses (parvoviridea) are small, single stranded negative sense, non-enveloped DNA viruses having size of 5.2 Kb. It is resistant to drying, heat, humidity and cold, that can persist in the environment for longer time. It is thought that CPV evolved from feline pan leukopenia virus (FPLV) or from a form of parvovirus that affected wildlife and cause hemorrhagic diarrhea. There are two types of CPV; type 1 (CPV-1) and type 2 (CPV2). Currently CPV 2 is the dominant and pathogenic and primarily affects puppies aged 6 weeks to 6 months of age. Parvovirus is less likely to affect older dogs because of their immunity through natural infection or immunization (Cotmore *et al.*, 2014; Murphy, 1999).

Canine parvovirus 2 affects dogs' gastrointestinal tracts and most commonly spread by direct dog-to-dog contact and contact with contaminated feces, environments, or people via the fecal-oral route, although it can also be spread through the fecal-nasal route. After the virus is ingested it replicates in the oropharynx, thymus and mesenteric lymph nodes after 2 days. The virus then moves in to the blood and marked viremia develops within 1-5 days after exposure. Then it reaches the intestinal crypts via the blood. Shedding of the virus begins on the third day and continues for seven to ten days post infection. The virus is readily transmitted from place to place by the dog's body and other objects (Oliveira *et al.*, 2018; Tion *et al.*, 2018).

The clinical signs of canine PV has two forms. Some of the signs of gastrointestinal forms of parvovirus include; lethargy, malaise, loss of appetite, abdominal pain and bloating, fever or low body temperature (hypothermia), vomiting, severe often foul smelling bloody diarrhea and hematochezia. Severe diarrhea and vomiting can cause hasty dehydration, and the intestines and immune system damage which can cause septic shock. The myocardial or heart form of parvovirus also includes dyspnea, cough, depression, ascites, tachycardia and death typically at 12-16 weeks of age (Rallis, 2016; Eftimov *et al.*, 2019).

A presumptive diagnosis of CPV can be made based on history, the clinical signs. Laboratory tests should be conducted on any dog with diarrhoea that is also displaying signs of systemic disease with

vomiting, loss of appetite fever, lethargy, dehydration or with remarkably profuse, smelling bloody diarrhoea, or known exposure to parvovirus within the preceding 14 days of developing diarrhea (Folitse *et al.*, 2017). The diagnostic tests which can be employed include; haemagglutination, virus isolation, ELISA, latex agglutination test, FAT, virus neutralization test, (PCR), nucleic acid hybridization or dot blot, nucleic acid sequencing. Differential diagnoses for this disease those exhibiting similar clinical signs include; infections by coronavirus, *E. coli*, parasitism, salmonellosis, campylobacteriosis, intussusception and foreign body obstruction (Decaro and Buonavoglia, 2012; Eftimov *et al.*, 2019).

Since there is no specific drug available that can kill the virus infecting dogs, and treatment is intended to support the dog's body systems until it can fight off the viral infection. Immediate and consistent treatment should be started primarily of intensive care efforts to avoid dehydration by replacing electrolyte, protein and fluid, controlling diarrhea and vomiting, and preventing secondary infections. Affected dogs should obtain good nursing care and kept warm. Treatment can be very expensive when the dog develops parvovirus, and it may die despite aggressive treatment. Vigorous treatment by early recognition is very important in successful control and prevention of the disease. With proper treatment, survival rates can approach 90% (Bastan *et al.*, 2013; Bhat *et al.*, 2013; Horecka *et al.*, 2020).

Canine parvovirus can be prevented and controlled by indoor and outdoor decontamination that enables to make the virus to lose its infectivity. Potassium peroxydisulfate has moderately effective activity in the faeces of organic matter, and can be sprayed on contaminated areas using a pesticide or other applicator. Active immunization is important for the protection of individual pet and population of susceptible dogs in the area. Modified live vaccines (MLVs) are presently used worldwide affording prolonged (7 years or longer) immunity that would confer protection against both disease and infection. The initial puppy vaccination series starts normally at 6-8 weeks of age, and then every 2–4 weeks until 16 weeks of age or older (Day *et al.*, 2016; Rallis, 2016).

CPV infection is now considered the most threatening disease to puppies between the time of weaning and 6 months of age (Eftimov *et al.*, 2019) and more cases were coming to the VTH facility of Addis Ababa University at CVMA with similar clinical signs and nearly the same age group. Thus, the current case report describes canine parvovirus infection in a puppy and its treatment outcome with combined antibiotic and supportive therapy.

## Description of the case

In this case study a five-months-old male local breed puppy from Bishoftu town kebele 14 was presented to VTH of AAU-CVMA, Bishoftu, on December 20/ 2020 with main complains of a puppy that was normally playful and agile suddenly becomes lethargy and withdrawn to itself three days before presentation coupled with inappettance, subsequent vomiting, rapid dehydration and diarrhea within the last 24 hours prior to clinical presentation. During physical examination the puppy had body temperature of 38.7°C, pulse rate of 92 beats/minute and respiratory rate was 28 beats/minutes, and the puppy had no a history of previous deworming, and vaccination with any infectious diseases preventing vaccines like canine parvo viral, canine distemper or rabies diseases.

The puppy later developed the prominent clinical signs noticed and classic clinical examination findings including dullness, anorexia, cachexia, rapid dehydration (prolonged skin tenting, sunken eyes), retching with vomition and voided bloody and projectile foul-smelling diarrhea which ranges from mucoid to purely hemorrhagic (figure 47 A and B). EDDIE App-based diagnosis was not used in this case, since this App has no data for pet diseases. Fecal sample was taken directly from the rectum and sedimentation and floatation techniques were conducted but revealed negative result for parasitic infection. Therefore, depending on history, clinical findings and age of the patient dog, the disease was diagnosed as canine parvovirus disease (CPV). Its differential diagnosis were coronavirus, collibacillosis, parasitism and campylobacteriosis.



**Figure 47:** Picture of canine parvovirus infection suspected dog (**A**, indicates the dog straining to excrete while, **B**, shows bloody diarrhea of the dog).

## Case management and treatment outcome

No specific antiviral agents are approved for treating canine parvovirus 2 infections. Therefore, CPV-2 infection mainly consists of supportive care and prevention of secondary complications. Hence, the puppy was treated promptly and aggressively based on the diagnosis with gentamicin sulfate injection 2ml: 80mg (Humanwell Pharmaceutical PLC, Ethiopia) at a dose of 4mg/kg body weight administered every 12 hours per day for three successive days and intravenous infusion of lactated ringer's solution (Aculife healthcare Pvt. Ltd. Gujarat, India) (figure 48) was used to restore fluid and electrolyte losses due to severe diarrhea and vomition.

In case of vomiting, the antiemetic, metoclopramide (Dietary supplements manufacture, China) injection which is a dopaminergic antagonist that blocks the chemoreceptor trigger zone and produces prokinetic outcome in the upper intestinal tract was also used. It was given at the recommended dose of 0.5mg/kg body weight intramuscularly repeated three times daily at an interval of 8 hours for the first day. The owner was advised to give clean feed and fresh water and keep hygienic conditions, deworm and vaccinate his dog regularly and take the affected dog to animal health facilities as early as possible to prevent and control the disease.



**Figure 48:** IV fluid substitution for losses due to CP (A, indicates 1<sup>st</sup> day rehydration while B, shows 2<sup>nd</sup> day rehydration with vitamin B complex therapy).

During follow up of the puppy on the second day, both vomiting and diarrhea were reduced in frequency and consistency. On the third day visit, the puppy was recovered from showing most of the signs of the disease, and the physiological parameters became normal which indicated improvement and recovery of the dog from the infection (figure 49).



**Figure 49:** Recovery of the puppy after successive and aggressive therapy with intensive follow up (**A**, indicates three days, **B** two months and **C** three months post treatment).

## Discussion

Canine parvovirus causes an extremely infectious and deadly disease that can develop into acute haemorrhagic enteritis and myocarditis in canines. Though, it's mostly diagnosed based on clinical signs such as vomiting, profuse foul-smelling bloody diarrhea and dehydration, documented information regarding the disease are rare (Miranda and Thompson 2016; Folitse *et al.*, 2017). However, CPV was first recognized in 1978 as a new pathogen of dogs (Zhao *et al.*, 2011), a detailed approach to confirmatory diagnosis of the CPV disease based on different diagnostic approaches is seldom employed in most developing countries. As such, depending on history and the prominent clinical signs noticed during study and classic physical clinical examination findings of the patient, the current case of the dog was diagnosed tentatively as canine parvovirus disease.

(Fagbohun *et al.*, 2020) indicated that poor hygienic conditions and the nature of virus which persists from the environment of animals causes severe disease most commonly in rapidly growing young dogs (puppies) between six weeks and six months of age. Different literatures indicated that clinical manifestations by CPV include loss of appetite, depression, vomiting, and profuse foul smelling hemorrhagic diarrhea are observed as investigated by (Rallis, 2016; Bhargavi *et al.*, 2017) that are in agreement with the presenting manifestations showed by the puppy in the current case report.

One of the major noticeable clinical signs in this case were intractable vomiting and projectile foul smelling diarrhea which can cause rapid electrolytes in-balance and depletion. So, the treatment protocols followed were intended at curing the puppy through restoration of fluid loss due to

vomition and diarrhea and avoiding of further secondary complications by different microbial pathogens. Therefore, IV lactated ringer's solution for fluid loss and gentamicin sulfate for secondary bacterial prevention and IM metoclopramide for vomiting were administered. This protocol is in agreement with the practices stated in the literatures indicating rehydration and antimicrobial as integral therapy for puppy with parvovirus by (Odueko, 2019; Bhat *et al.*, 2013; Dongre *et al.*, 2013; Horecka *et al.*, 2017; Judge *et al.*, 2015). These authors also stated that without treatment, CPV can be life threatening due to severe fluid losses and electrolyte derangements secondary to anorexia, vomiting, diarrhea, endotoxin and other body system dysfunctions indifferent to the current case report.

Eventhough, further laboratory confirmation was not performed for this case (limitation of the study) because of lack of rapid and specific kits for the virus; the puppy was treated vigorously based on history and clinical pictures that provided complete recovery of the puppy. In conclusion, canine parvovirus is a very common problem of dogs and is a huge killer of puppies. Therefore, in order to ensure the best outcome and to prevent further complications, treatment should be aimed towards symptomatic supportive care, aggressive fluid therapy, anti-emetics and antibiotic therapy with nutritional support which can increase the survival rate of the dogs.

### 3.3.3. *Foot and Mouth Disease; a case of young bull and early lactating cow*

#### Abstract

Foot and mouth disease (FMD) is severe and highly contagious viral disease affecting cloven-hoofed animals and cause trade and production losses globally. A local breed young bull and early lactating cow were presented to VTH of AAU-CVMA, Bishoftu, with major complaints of anorexia, reduction in draught power of the bull and milk production for 2-3 days in the cow. During physical and clinical examination of the bull and cow, elevated body temperature (41.3 and 42.7 °c respectively) and relatively normal value of other vital signs were recorded. Inspection of the oral cavity and inter digital space revealed blister like lesions and sloughing of the tongue. Reduction of draught power and milk, fever, drooling of saliva, shivering, stamping or kicking of the feet, vesicles on buccal mucous membranes and between the claws, erosions of tongue due to ruptured vesicles were also observed clinically. After clinical, EDDIE and laboratory examination as FMD, the case was managed and treated with 20% oxytetracycline, dexamethasone injection and iodine tincture for interdigital lesions.

FMD is extremely contagious acute disease of all cloven-footed animals, characterized by fever, salivation, smacking of lips and blister-like sores in the mouth (tongue and gums), on teats and between hooves. However, its treatment and control measures can be attained by the use of antipyretic and analgesic drugs and broad spectrum long-acting antibiotics.

***Key words; Bull, Cow, Foot and Mouth Disease***

## Introduction

Foot and mouth disease (FMD) is highly infectious and severe disease of cloven-hoofed ruminants or artiodactylae, mostly cattle, swine, sheep, goats, and many species of wild ungulates. It affects extensive areas globally by threatening the cattle industry and is included in the list of diseases notifiable to the world organization for animal health (WHO) as a significant epidemic disease. Since FMD is the major transboundary animal disease, it produces the most important constraint on international trade in animals and their products (FAO, 2019). The endemically or sporadically infected countries like Ethiopia generally face total restrictions on the export of their live animals and fresh meat and other products to the FMD-free countries. In addition to trade restrictions, it also severely reduces the productivity of meat and milk industries and it is also an under-diagnosed cause of juvenile livestock mortality (Alexandersen *et al.*, 2017; Rahman *et al.*, 2020).

Foot and mouth disease virus (FMDV) in the genus Aphthovirus of the family Picornaviridae is causative agent of FMD. FMDV is a single stranded positive sense RNA Virus which has seven different types of serologically, immunologically and genetically distinguishable strains namely; A, O, C, SAT1, SAT2, SAT3, and Asia1) which are endemic in different countries worldwide. Each strain requires a specific vaccine to provide immunity to a vaccinated animal since they do not confer cross immunity (Grubman and Baxt, 2004; Constable *et al.*, 2017).

The disease can be transmitted by direct contact between infected and susceptible animals and contaminated inanimate objects (hands, footwear, clothing, vehicles), consumption of untreated contaminated animal products, artificial insemination with contaminated semen, inhalation of infectious aerosols, airborne, especially temperate zones (up to 60 km overland and 300 km by sea). The most common way by which the virus spread is via movement of infected animals which shed large volume of FMDV virus with incubation period of 2-14 days. Different animal species contribute a significant role in the maintenance of the disease. Cattle acts as indicator host; sheep, goat and African

buffalo (*Syncerus caffer*) acts as a reservoir while elephant is the maintenance host for FMD in which pig is amplifier host (Yadav *et al.*, 2020; Paton *et al.*, 2018; Tadesse *et al.*, 2021).

The severity of clinical signs of FMD will depend on exposure dose, strain of virus, age and species of animal and host immunity. It is clinically characterized by loss of appetite and condition, fever, salivation, marked production loss and blister-like sores (vesicles) on the tongue, gum and lips, on the teats and between the hooves. Even though the majority of affected animals can recover, the disease often leaves them weakened and debilitated (Azeem *et al.*, 2020). FMD can be diagnosed by clinical signs but confirmation of any suspected case is done through laboratory tests which includes virus isolation, CFT, liquid-phase blocking ELISA, sandwich-ELISA, multiplex-PCR, recombinant antigen-based diagnosis, microarray and nucleic-acid-based diagnostic methods and recently DIVA test. It can be differentially diagnosed from vesicular stomatitis, vesicular disease, bovine viral diarrhea, mucosal disease, infectious bovine rhinotracheitis, bluetongue and malignant catarrhal fever (Alexandersen *et al.*, 2017; Longjam *et al.*, 2011).

Since the disease has no specific treatment, it can be managed, prevented and controlled by early detection and warning systems, rapid response measures, animal movement restriction, vaccination and culling, sometimes in combination and biosecurity practices to prevent introduction/spread of the virus along with contingency planning for potential outbreaks to eradicate the disease. The economic impact of this disease is production losses (milk, draught power, abortion, retardation of growth and breeding, mortality and treatment costs) and market restrictions, costs of control and re-eliminating it in the face of an outbreak (OIE, 2013; Rawdon *et al.*, 2019). However, there is no accurate annual estimation of economic impact of FMD in Ethiopian in terms of visible production, trade and mortality losses and vaccination costs in endemic regions, it causes huge losses in different outbreaks (FAO, 2019; Jibat and Berhanu, 2013). Thus, the current case report describes a case of FMD in young bull and early lactating cow and its treatment outcome.

#### Description of the case

On the first week of January 2021, a local breed adult bull and early lactating cow were presented to VTH of aau-CVMA, Bishoftu, with major complaints of anorexia, salivation, reduction in draught power of the bull and milk production for 2-3 days in the cow, then smacking of the lips, grinding of

the teeth and drooling of saliva. The owners also complained that most of the animals especially cattle around their peasant association are affected by a disease showing similar symptoms to this case.

During physical examination of the bull and cow, body temperature of 41.3 °c and 41.7 °c, respiratory rate of 18 and 20 breathes/minute and heart rate of 60 and 74 beats/ minutes were recorded respectively in each animal. Inspection of the oral cavity revealed blister like lesion on the gums and sloughing of the tongue. Up-on clinical examination reduction of draught power and milk, fever, drooling of saliva (figure 50A), lameness, smacking of the lips and shaking (kicking) of the feet, vesicles on buccal mucous membranes and between the claws (figure 50B), erosions of tongue due to ruptured vesicles were observed (figure 50C). Therefore, based on clinical signs observed and EDDIE App-based result, the case was tentatively diagnosed as Foot and Mouth disease which is differentially diagnosed from mucosal disease, blue tongue and IBR.



**Figure 50:** Pictures of FMD suspected bull and cow (A, indicates drooling of saliva, B, lesion between inter digital space and C, indicates erosion of tongue and salivation).

#### Laboratory investigation and its findings

One gram of tissue sample from recently ruptured vesicles from the tongue, and vesicular swabs were collected and placed in a transport medium. Then, transported with an ice box to veterinary microbiology laboratory of AAU-CVMA, Bishoftu and frozen at -20 °c until processed. These samples

were again sent to NAHDIC, Sebeta, Ethiopia for confirmation of the cases and processed by real time PCR, giving a positive result. Therefore, based on clinical signs, EDDIE App-based disease diagnosis and laboratory results, the case was finally confirmed as Foot and Mouth disease.

#### Case management and treatment outcome

The case was managed and treated with long-acting oxytetracycline (Gongyi pharmaceutical Co., Ltd, No. 298, Shanghai, China) with a recommended dose of 1ml/10kg body weight IM for two days within an interval of 72 hours, non steroidal anti-inflammatory dexamethasone sodium phosphate injection (Lincoln parenta LTD, Gujarat, India) 1.5ml/50kg body weight IM for three days and iodine tincture and lemon for interdigital and oral lesions were also used. The owners were advised to isolate these animals from others by providing easily palatable and soft feeds, and the one who has the infected cow was also advised to wean the calf by providing other healthy cow's milk until recovery. Following these recommendations and therapy, drooling of saliva and body temperature were reduced within 24 hours and the animals commenced normal feeding but ulcers started to heal around day 10 after infection, and complete recovery with good body condition was achieved after a month (figure 51).



**Figure 51:** Pictures indicating recovery of lesions due to FMD affected animals.

#### Discussion

Foot and Mouth disease is one of the most highly contagious diseases of cloven-footed animals and it is caused by rapidly replicating and spreading FMDV. It affects the production and reproduction of animals by interfering the feeding and breeding of animals as a result of development of lesions on tongue, foets and teats (Constable *et al.*, 2017). The disease is estimated to circulate in 77% of the global livestock population, in Africa, the Middle East and Asia, as well as in a limited area of South America. This disease has been recognized as the most important constraint to regional and

international trade in animals and animal products since it is one of the major transboundary animal disease (OIE, 2013; FAO, 2019).

In addition to trade embargo, the impacts of FMD is largely associated with the livelihood of smallholder farmers in developing countries like Ethiopia, that it causes high morbidity in the cattle population and associated economic losses which represent significant part of smallholders' income (Tadesse *et al.*, 2021; Wubshet *et al.*, 2019). According to (Jibat *et al.*, 2013) FMD ranked first in Borena zone where livestock-related livelihood accounted about 31% of food and income source in which milk constituted 50% daily diet in Borena (Bayissa *et al.*, 2011). Morbidity of the disease due to lack of appropriate prophylaxis, effective control and preventive measure can reach 100% in susceptible cattle populations. Mortality is generally low in adult animals (1-5%), but higher in young animals (20% or higher) (Opperman *et al.*, 2014; Dubie, 2020; Nyaguthii *et al.*, 2019).

In this case report, the clinical signs observed were reduced feed intake, body condition, draught power and milk production, drooling of saliva, vesicular lesions on buccal mucous membranes and between the claws, sloughing of the tongue, fever, smacking of the lips and shaking (kicking) of the feet. These findings were in agreement with the cases of FMD reported by (Abubakar *et al.*, 2014; Chalutwan *et al.*, 2020) as a single case or rare outbreak in different areas. The disease can be easily diagnosed by clinical signs and different laboratory tests such as virus isolation, CFT, different types of ELISA, PCR and nucleic-acid-based diagnostic methods (Maruf *et al.*, 2018; King *et al.*, 2018) but what makes it challenging is unavailability of well-organized laboratories in the farms, clinics and hospital levels that can clearly detect the circulating serotypes of FMD in different agro-ecological zones of different countries including Ethiopia for the effective prevention of the disease by vaccination with a specific monovalent strain vaccine as encountered in the current case.

An animal affected by Foot and mouth disease has no specific treatment but symptomatic treatments may be recommended for the control and prevention of secondary colonization of other microorganisms. Broad spectrum long acting antibiotics may be given parenterally and topically on feet and mammary tissue lesions. Additionally, anti-inflammatory drugs as analgesic and antipyretic purposes and antiseptic solutions like iodine formulations, potassium permanganate or sodium bicarbonate can be applied over mouth lesions (Bachanek-bankowska *et al.*, 2016; Constable *et al.*, 2017; Chen *et al.*, 2017). This treatment protocol and case management procedure is in line with the

treatment and management of the current case report which was treated by long acting oxytetracycline, dexamethasone and iodine tincture that provided a better outcome.

In addition to this treatment procedure, recommendations were also given to the owners to control and prevent the disease by isolation of affected animals, avoiding calves to suckle from affected dams and milk from affected animals, restriction of animal movements, purchase animals and fodder from a place where FMD has not been recorded for a period of 6 months, vaccination of all animals of an area/village at one time can effectively reduce the losses associated with foot and mouth disease. This agrees with the control and preventive measures of the disease as forwarded by (Mohamed and Shaapan, 2019; Cepeda *et al.*, 2016; Constable *et al.*, 2017). In conclusion, FMD is extremely contagious acute disease of all cloven-footed animals, characterized by fever, salivation, smacking of lips and blister-like sores in the mouth, teats and between hooves. However, its treatment and control measure can be attained by the use of antipyretic and analgesic drugs and broad spectrum long acting antibiotics.

### **3.4. Case reports on Non-infectious Diseases of Livestock**

#### *3.4.1. Milk fever/ clinical hypocalcaemia; a case of ewe and its management and treatment outcome*

##### Abstract

Hypocalcaemia (Milk fever) is a metabolic disturbance affecting lactating animals immediately after or just before parturition when blood calcium levels fall below a normal level. On December 07/2020, a recumbent 50 kg body weight old-aged ewe in late pregnancy was presented to VTH of AAU-CVMA, Bishoftu, with chief complaints of an ewe sitting down on her brisket and unable to stand up, reduced feed intake and has history of repeated and big sized lamb delivery. It was confined at home for three days. During physical and clinical examination, vital signs indicate subnormal temperature (37.8 °C), increased respiratory rate (36 breaths/minute) and heart rate (92 beats/minute) and up on palpation and percussion the rumen feels fluctuating appearance and tympanic sounds respectively. The EDDIE App diagnosed the disease as pregnancy toxemia. The ewe didn't respond to treatment by 40% glucose but it responded to treatment of calcium borogluconate administered IV without relapse within twenty minutes. Finally, based on history, clinical signs and response of the ewe to calcium borogluconate, the case was confirmed as clinical hypocalcaemia. Hypocalcaemia/milk fever in sheep can occur in the last weeks of pregnancy and affected animals responded quickly to an injection of commercial calcium

solution if given early in the course of the disease. Hence, early recognition, proper treatment and elimination of predisposing factors should be considered to avoid this disease.

**Key words;** *Calcium, Ewe, Hypocalcaemia, Milk fever*

## Introduction

Milk fever (hypocalcaemia) is one of the most common, mineral-related metabolic disturbance affecting lactating animals immediately after or just before parturition as a result of a low level of calcium in the blood. It is associated with the channel of calcium (Ca) within the fetus and milk during pregnancy and parturition respectively (Goff, 2020). Hypocalcaemia (parturient paresis) occurs in different livestock species such as cattle, sheep, goat and buffalo that develops when the level of calcium in the blood goes to down 10mg/dl or less. In ewes it is usually seen in late pregnancy and characterized by anorexia, lethargic, unable to move, recumbency, subnormal rectal temperature and sluggish pupillary light reflection and relaxed of anal sphincter (Michael *et al.*, 2020; Guadu and Chanie, 2013; Constable *et al.*, 2017).

Hypocalcaemia is an acute to peracute, febrile disease of mature female animals which is manifested by changes in behavior, generalized paresis and circulatory collapse. It is a preventable disease and is different in sheep as compared to cattle in that ewes often develop most cases pre-lambing, as was the case here, while in cows most cases occur after calving (Bzuneh and Alemneh, 2020). Additionally, in cows a diet high in calcium during the dry period inhibits calcium mobilization from bone, leading to a possible calcium deficiency shortly after calving. Sheep do not seem to share this problem with cows and a diet with sufficient calcium should be fed during the 6 weeks up to lambing to ensure that milk fever cases are manageable (Fikadu *et al.*, 2016).

The potential causes of parturient paresis is deficiency of metabolizable calcium ion intake in the circulation under circumstances of higher calcium requirements, usually during late gestation. It is also caused by low dietary Ca and vitamin D supplement, improper ratio of Ca and Phosphorus (P) (2:1) and also imbalance of parathyroid hormone and calcitonin (Thompson and Masters, 2015). Additionally, it occurs when animals consume oxalate containing plants that bind the calcium in the blood, rendering the calcium unavailable for use by the ewe. Alkalosis due to excessive cations of potassium, sodium, Ca and magnesium and hypomagnesaemia in periparturient animal increases the

vulnerability of hypocalcaemia. Some cases are complicated by concurrent pregnancy toxemia (West *et al.*, 2019).

The onset of the disease strikes abruptly and often follows within 24 hours, when there is a sudden change of feed, weather, or short periods of fasting imposed by circumstances such as shearing or transportation (SNV, 2017). In early hypocalcaemia in sheep, the most commonly observed signs are weakness, anorexia, stiff-uncoordinated gait, grinding of teeth, ataxia, drowsiness, salivation, constipation, and depressed rumen motility, bloat, recumbency, loss of anal reflex, stretched-out head with chin on the ground and legs stretched out or folded underneath the animal, sitting down on her brisket and unable to get up and if untreated death commences within 24 hours (Jadhav *et al.*, 2018). The symptoms of milk fever and pregnancy toxemia are similar, however the onset of milk fever to develop seems more suddenly. The ewe's response to calcium therapy is the differential diagnosis. The key to both conditions is early recognition, proper treatment and elimination of the predisposing factors (Shankar, 2015; Kelay and Assefa, 2018).

Diagnosis of hypocalcaemia is made based on history and clinical signs. A tentative diagnosis can be supported and confirmed by a rapid response to treatment with IV injection of calcium solutions. Biochemical tests on blood samples such as; total serum calcium (2.8-3.2 mmol/L for sheep and 2.2–3.05 mmol/L for goats = normal values), magnesium, inorganic phosphate levels and some tissue enzymes can also be measured (Aktas *et al.*, 2010; Silk, 2013). In outbreaks occurring before parturition, pregnancy toxemia is the main differential diagnosis. These diseases also occur concurrently. At the same time, urine ketone or serum  $\beta$ -hydroxybutyrate levels should always be evaluated. Other diseases that can be differentially diagnosed from hypocalcaemia are listeriosis, scrapie, hypomagnesamia and clinical GI parasitism (Fakour and Hajizadeh, 2016; Hasan, 2019).

Parenteral injection of calcium salts is the standard practice of milk fever treatment. Intravenous calcium borogluconate is the preferred treatment given slowly with the recommended dose of not more than 20 ml IV to avoid muscular and nervous damages and recumbency. It can also be administered through SC and IP routes with a dose rate of one gram calcium per 45 kg of body weight. The affected ewe will respond to calcium injections very rapidly. The ewe may have ketosis in addition to milk fever, if it does not show signs of recovery within hours of calcium treatment. So, dextrose intravenously or propylene glycol orally and possible glucocorticoid treatment will help for energy deficiency (Zhang *et al.*, 2020; Constable *et al.*, 2017).

As a prevention and control, provide feed with enough calcium during the last 6 weeks of gestation until 4 weeks after lambing. Reduce low-calcium feeds that include low-quality hay, grains and straw. If sheep are confined out of sunlight for an extensive period, they may suffer from vitamin D deficiency which reduces the uptake of calcium in the gut (Thilsing and Jorgensen, 2020). Physical stresses at the last month of pregnancy, grazing late pregnant or lactating ewes on lush pasture or cereal crops should be avoided and keep calcium and magnesium solution and vitamin D supplementation on hand while handling pregnant or lactating ewes (Ataollahi *et al.*, 2020; McGrath *et al.*, 2015). Thus the current case describes clinical hypocalcaemia/ milk fever in late pregnant ewe with its management and treatment outcome.

#### Description of the case

On December 07/2020, a recumbent 50 kg body weight old-aged ewe in late pregnancy was presented to VTH of AAU-CVMA, Bishoftu. The ewe was transported by a cart with major complaints of, sitting down on her brisket, stretched-out its head with chin on the ground and unable to stand up. The ewe has reduced feed intake and has a history of repeated and big sized lamb delivery, and it was confined at home for three days, and treatment and regular deworming were not given. At the time of clinical observation and investigation, vital signs indicate subnormal body temperature (37.8 °C), increased heart rate (96 beats/minute) but decreased intensity of heart, respiratory rate of 36 breaths/minute and the rumen feels fluctuating appearance and tympanic sounds up on palpation and percussion respectively. The clinical signs observed were weakness, loss of appetite, stiff uncoordinated gait, grinding of the teeth, ataxia, drowsiness, salivation, constipation, and depressed rumen motility, progressing to hyposensitivity, bloat and recumbency (figure 52). The EDDIE App diagnosed the disease as pregnancy toxemia.

Based on history and clinical findings, the case was tentatively diagnosed as clinical hypocalcaemia/ milk fever. It was differentially diagnosed from pregnancy toxemia, listeriosis and clinical GI parasitism. In order to differentiate pregnancy toxemia from hypocalcaemia, 40% glucose was used as a treatment option but the ewe didn't respond to this treatment. But, it responded well to treatment of 40% calcium borogluconate administered intravenously within twenty minutes and relapse did not occur. Finally due to response of the ewe to calcium borogluconate and the above tentative diagnosis findings, the case was confirmed as milk fever/clinical hypocalcaemia.



**Figure 52:** Picture of ewe setting down on its brisket and stretched-out its head with chin on ground.

#### Case management and treatment outcome

This case was first managed for ruminal tympany by puncturing on the left flank with a sterile 20 gauge treatment needle, and removing the gas. Then, the ewe was treated with 40% glucose solution IV but it didn't respond to this treatment. Hence, calcium borogluconate solution (Norbrook laboratorie limited, Newry, Northern Ireland) at a recommended dose of 1ml/kg was administered intravenously and subcutaneously (figure 53A). The ewe responded to this treatment within twenty minutes without relapse (figure 53B). Since calcium borogluconate has no any antibiotic effect for complicated cases, fortified procaine penicillin injection 4,000,000 units (Intracin Pharmaceuticals Private Limited, Gujarat, India) was also used at recommended dose of 200,000 IU/kg body weight intramuscularly for three successive days once a day. Finally the ewe has recovered from this metabolic disorder and delivered a good-looking male lamb at the end of that night.



**Figure 53:** IV administration of calcium borogluconate (A) and its response after 20 minutes (B).

After the ewe has responded to treatment, it was discharged from VTH to its home and has delivered a male lamb with good body condition and big sized at that night (after 18 hours of admission and treatment) as indicated in figure 54 below.



**Figure 54:** Picture of recovered and delivered ewe with its lamb after a day.

#### Discussion

(Hernandez and Bruckmaier, 2020; El-khodery *et al.*, 2018) has pointed out that hypocalcaemia in sheep is almost always resulted from failure of the endocrine mechanism to promote influx of calcium from bone and the alimentary tract rather than from inadequate dietary calcium. However, in this case old age, repeated and large sized lambing, physical stress and long-term grain feeding without calcium supplementation were the main contributing factors for the development of hypocalcaemia other than endocrine and other metabolic disturbances.

In the current case, the clinical findings indicate increased heart rate (92beats/minute) but decreased intensity of heart, subnormal temperature (37.8 °c), weakness, stiff uncoordinated gait, grinding of teeth, ataxia, drowsiness, bloat and sitting down on its brisket by stretched-out its head with chin on the ground and unable to get up (recumbency). These signs along with history of repeated and big sized foetal pregnancy, physical stress due to long time confinement in the house with reduced calcium rich feed supplementation and response of animal to calcium borogluconate treatment indicates milk fever disease/clinical hypocalcaemia. This is in line with the findings of (Almaghamsi *et al.*, 2018; Allan *et al.*, 2015; Constable *et al.*, 2017).

The indicators of milk fever and pregnancy toxemia are similar, though the onset of milk fever to develop appears more rapidly. The differential diagnosis is the ewe's response to calcium therapy (Schmitt *et al.*, 2018; Constable *et al.*, 2019). Early recognition, proper treatment and eliminating the predisposing factors are the key for both conditions. In the present case, the ewe immediately before parturition which was suffered from hypocalcaemia responded well to intravenous infusion of calcium borogluconate which is in agreement with (Hibbs, 2017; Jadhav *et al.*, 2018; West *et al.*, 2019), who reported the association of reproduction and production diseases in dairy cows and ewes.

The manipulation of the dietary cation-anion balance is a popular method of managing hypocalcaemia but after the occurrence of the disease, supplementation by commercial calcium is recommended to avoid recumbency and cardiovascular disturbances. For the present case intravenous calcium borogluconate was preferred and given for treatment of the case with the recommended dose and the owner was recommended to provide calcium rich feeds to the ewe. Affected sheep has responded well very rapidly to this injection and gave delivery without any complication. This is in agreement with the treatment recommendations of hypocalcaemia of the pregnant ewe by (Al-bayati, 2019; Jadhav *et al.*, 2018; Jalal *et al.*, 2017). In conclusion, hypocalcaemia/milk fever in sheep can occur in the last weeks of pregnancy and affected animals responded quickly to an injection of commercial calcium solution if given early in the course of the disease, and hence, early recognition, proper treatment and elimination of the predisposing factors should be considered to avoid this disease.

### 3.4.2. Subcutaneous benign tumour; a case of an ox and its management

#### Abstract

Tumor or neoplasm is an abnormal mass or swelling of tissue which results when cells divide more than they should beyond brain's control. This case report describes, a successful management of subcutaneous benign tumour on an adult local breed ox having a body weight of 295 kg that was presented to VTH of AAU-CVMA, Bishoftu, on February 24/2021. It has a primary complaint and a history of firm and cold swelling at the caudal part of mandible on the lateral side of neck region that has spent over four years. Aspiration of the swelling with a sterile 16 gauge needle with syringe didn't detect or withdrawn any of the contents (pus, fluid, blood and other). The EDDIE App-based diagnosis revealed in this case as abscess. Cytological examination of tissue smears resulted immature and irregular shaped cells which have large darker nucleus. Based on history, clinical signs and cytological staining result, the case was diagnosed as subcutaneous benign tumor which is differentially diagnosed from abscess, oedema, cascious lymph adenitis and haematoma. It was managed by surgical resection and intramuscular injection of penicillin G procaine with wound spray topically for three successive days. Complete recovery of the ox was achieved after three weeks. Surgical resection accompanied with topical application and parenteral administration of antibiotics can give successful outcome on the management of localized subcutaneous benign tumours after proper identification and effective analgesics.

**Key words;** *Benign Tumour, Surgical removal, Ox,*

#### Introduction

In a healthy body, cells grow, divide, and replace each other and old one die in the body of both animals and human. But when there are too many new cells that are proliferated too quickly by varying in size from a tiny nodule to a large swollen mass, depending on the type without the control of brain in which the body does not need them are considered as tumour/ neoplastic or cancer cells. These cells cause the disease condition called tumour or neoplasm which affects all species of animals and all parts of the body. A tumour or cancer is a soft or hard tissue mass characterized by excessive, persistent and disorganized cell growth that is unresponsive to normal control and treatment mechanisms (Khalil *et al.*, 2020; Lakshman, 2019).

There are three main types of tumors each having different effects and names in the body namely; benign tumours which are characterized as non-metastatic or cannot grow, or do so very slowly and once removed they do not generally return; premalignant tumours are not yet cancerous, however they have the potential to become malignant; and malignant tumours which are cancerous and the cells can grow rapidly and metastatic to other body parts. Most benign tumors are not dangerous, and they are unlikely to metastasize and affect other parts of the body. But they can cause pain or other problems if they produce pressure against nerves, blood vessels or other vital organs or if they trigger the overproduction of hormones. Several factors contribute to the development of different tumors including chemical exposure, old age, genetic susceptibility and nutrition, UV light and different viruses (Shruthi *et al.*, 2018; Agnew and MacLachlan, 2016).

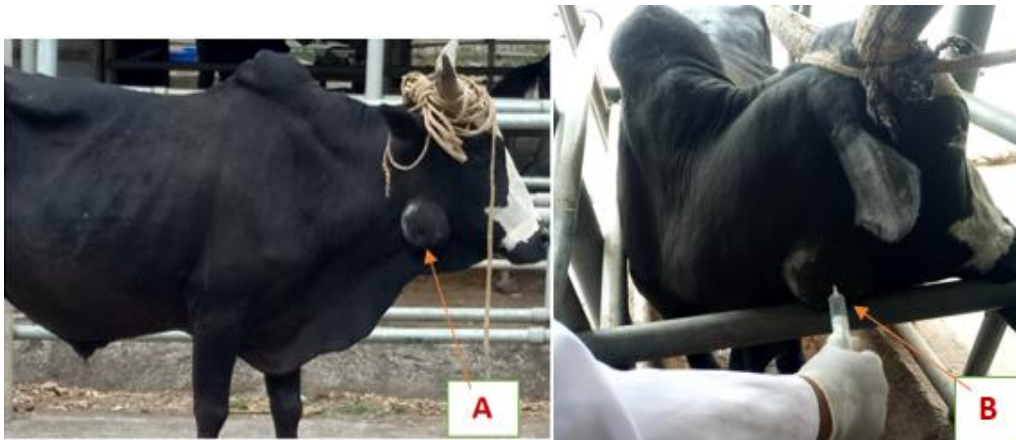
Tumour/ cancer cells can be distinguished from normal cells by microscopic examination from cell samples with different cytological staining methods by giemsa, wrights, modified wright stain (wright-giemsa) and good-quality rapid romanowsky stains. Cytology can be used to diagnose the masses or growths (tumors) found on the surface of the body, but it can also assess different body fluids and internal organs and is often used for preliminary evaluation to establish a working diagnosis and as needed, plan surgery. Additionally, tumour or cancer cells can be diagnosed and confirmed by histopathology techniques. The differential diagnosis of tumour can be abscess, oedema, hernia, cascious lymph adenitis and haematoma (Zainab, 2016; Gilvarry *et al.*, 2011).

Bovine tumour is of great concern now a days as it causes economic losses due to undesirable impact on animal health and productivity and thus it reduces profitability to individual farmer and livestock industry. A systematic research to find out the specific pattern of bovine tumour occurrence, application of advanced diagnostics techniques and its effective treatment in animals revealed scarce information in Ethiopia. The occurrence of different tumours is in rising tendency in the world in which the frequency of tumours in bovine is relatively increased and ranked second place following tumours of canine with no effective and available medical treatments in most developed countries (Katare *et al.*, 2016; Marosfoi *et al.*, 2009; Khalil *et al.*, 2020) . Therefore, the current case report describes a case of subcutaneous benign tumour of an ox and its management outcome.

## Description of the case

An adult local breed ox having a body weight of 295 kg with a primary complaint of firm swelling that has a history of progressive development at the caudal part of mandible on the lateral side of neck region. The swelling has spent over four years and the case was referred from kality kebele veterinary clinic and presented to VTH of AAU-VMA, Bishoftu, on February 24/2021. Physical examination revealed the respiratory and heart rate to be within the normal physiological limits with slight elevation of body temperature (39.6 °c) and firm and cold swollen mass was palpatet.

During clinical examination, the ox showed minor depression, reduced body condition, firm, cold and swollen mass at the caudal part of mandible from the lateral side of neck region as indicated in figure 55A below. In order to differentiate this swelling from abscess, oedema, cascious lymph adenitis and hematoma, a sterile 16 gauge needle with syringe was inserted at its most ventral part for aspiration to detect the contents (pus, blood, fluid and other) but any type of content was not withdrawn (figure 55B). The EDDIE App-based diagnosis revealed in this case as abscess. Based on history of development and age of the animal and swollen mass, and clinical signs, the case was tentatively diagnosed as subcutaneous benign tumor and differentially diagnosed from abscess, oedema, cascious lymph adenitis and haematoma.

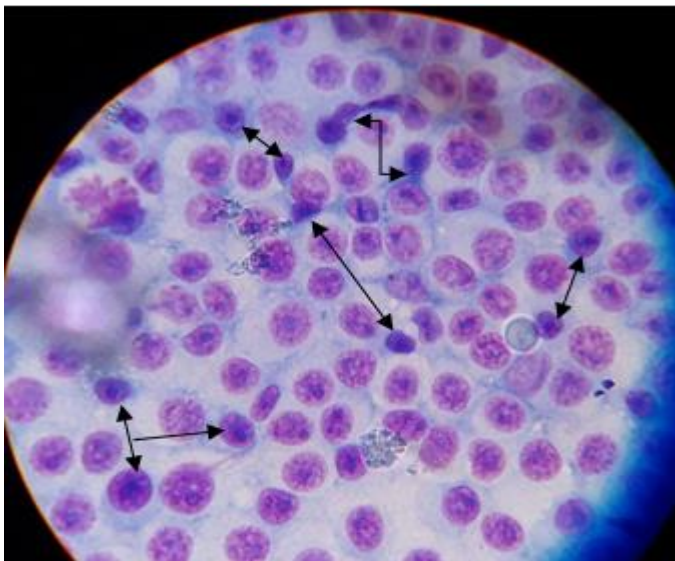


**Figure 55:** Picture of the ox suspected with subcutaneous benign tumor (**A**, indicates firm swollen mass caudal to mandible while **B**, showed fine needle aspiration without any content).

## Laboratory investigation and its findings

From excised mass of tumor, a piece of tissue sample was taken and immediately transported to veterinary clinical pathology laboratory of AAU-CVMA, Bishoftu. Cytological analysis by modified

wright stain (wright-giemsa) was conducted from different smears (impression and crushed tissue smears). Microscopic examination by x100, resulted irregular shaped cells which are immature and out of control in growth that have large darker nucleus (figure 56). Therefore, based on history of development and age of the animal and swollen mass, clinical signs and cytological laboratory findings, the case was finally diagnosed as subcutaneous benign tumor.



**Figure 56:** Cytological result of excised tumor from the ox by modified wright stain (arrows indicate immature and irregular shaped cells with large darker nucleus).

#### Case management and treatment outcome

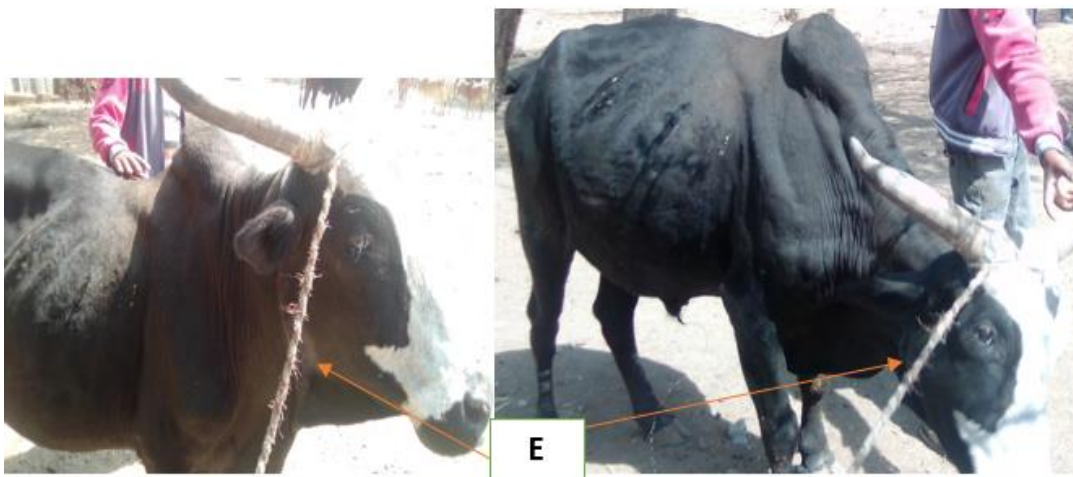
This case was managed and treated by surgical removal of the swollen mass (tumour) by the following procedures and protocols; after the hair was clipped from the area where the tumour was excised, it was cleaned with clean water and savlone and aseptically prepared followed by achievement of analgesia with local infiltration of 2% lidocaine HCl around the incision site, then an ellipsoidal incision was made (figure 57A) with proper haemostasis followed by blunt dissection of the structure to separate at the base without causing any injury to the jugular furrow (figure 57B).

Then a ball like mass (tumour) was successfully removed (figure 57C). The healthy tissue at the base was checked for blood supply and ligated properly with chromic cut gut. Then penicillin G procaine powder was applied topically to the vacant hole followed by suturing of the edges of the skin by interrupted horizontal mattress with silk (figure 57D) which was removed after two weeks. Finally, chlortetracycline (cyclo spray) (Farvet Laboratories B.V., Netherlands) topically and intramuscular

injection of penicillin G procaine (Hebei Hope Harmony pharmaceutical Co., Ltd., China) with the recommended dose of 1ml/15kg (400,000 units/kg) body weight per day for three successive days were used. After this management and treatment protocol, the ox has successfully recovered from the problem after three weeks as indicated in figure 58 bellow.



**Figure 57:** Pictures indicating surgical removal of subcutaneous benign tumor from the ox (A, ellipsoidal incision of swollen mass, B, blunt removal of the tumour, C, ball like tumour after excision, D, vacant hole due to removed mass of tumour, E, incision site after excision of tumour and skin suture).



**Figure 58:** Picture showing recovery of the ox with disappearance of the swollen mass after two (left) and three (right) weeks.

## Discussion

Tumour, an uncontrolled propagation of cells in the body have different forms and its occurrence and effect in all species of animals and human is increasing globally in which dogs have high incidence and stand first by developing different tumours followed by bovine. Bovine tumors affecting skin and appendages form a major constituent of all other neoplasms in animal health practice. Among the skin tumors, the commonly diagnosed and economically important skin tumours/ neoplasms in large animals include bovine cutaneous papillomatosis, squamous cell carcinoma and different localized subcutaneous benign tumours. Currently the incidence of bovine tumour/ neoplasm is relatively increasing which causes massive economic losses due to decreased production in meat and milk yield, carcass condemnation, high treatment cost and morbidity and mortality of animals (Khalil *et al.*, 2020; Marosfoi *et al.*, 2009; Gilvarry *et al.*, 2011).

In the current case report, the clinical signs observed were depression, reduced body condition and draught power as the owner reported and development of a swollen mass at the caudal part of mandible around the neck region that has age of about four years. This swelling has assumed to cause different effects on the animals like localized stress at the site of tumor, pressing of blood flow (since located on the jugular furrow) and nerve pass way, interfering with functions of different vital organs (esophagus, trachea, lymph nodes and others), secretion of excess amounts of biologically active substances (hormones) and reduction on the productive and reproductive efficiencies and general health conditions of animals as a secondary drawbacks. This finding agrees with the case report of benign melanocytoma in cow by (Katara *et al.*, 2016), genital tract tumours in cattle by (Martz *et al.*, 2020), occurrence of certain tumours in bovines by (Lakshman, (2019) and prevalence and factors associated with superficial tumors and tumor-like swelling in cattle by (Khalil *et al.*, 2020).

Reports with appropriate diagnosis and treatment of tumours in cattle are relatively rare when compared with reports on other domestic animal species. One expected reason is that most cattle do not reach an age old enough to predispose them to the development of tumours (Gruber and Klopfleisch 2020; Stromberg and Meuten, 2016). However, the prognosis and treatment or management outcome of begin tumours in cattle depend on the stage of tumour at diagnosis, the rate of metastases and the type and timing of the management and treatment. The surgical resection of different benign tumours on different body parts like melanocytoma and subcutaneous benign tumours is always indicated (Okawa *et al.*, 2016; Vamshi *et al.*, 2017; Manoj *et al.*, 2014). This agrees with the present case report and its

management and treatment approach that provides effective outcome on the ox to successfully recover within short period of time. In conclusion, surgical resection accompanied with topical application and parenteral administration of antibiotics can give successful outcome on the management of localized subcutaneous benign tumours after proper identification and effective analgesics.

### **3.5. Case reports on Concurrent Diseases of Livesock**

#### *3.5.1. Concurrent diseases of clinical coccidiosis and enteric colibacillosis; a case of a doe and its treatment outcome*

##### **Abstract**

Coccidiosis and Colibacillosis are debilitating diseases of young animals by causing loss of body condition, diarrhea and death worldwide. An adult local breed doe was presented to VTH of AAU-CVMA, Bishoftu on March 23/2021 with major complaints of inappetence, weakness and diarrhea for three days. The owner stated that the doe is kept in a semi-intensive management system and he also reported that two kids and a lamb had previously died of similar symptoms in the flock. Physical examination indicates the value of vital signs in the normal range but increased temperature, delayed capillary refill time and skin tent, pale and dry mucus membrane. Clinical examination also revealed that the doe was dull and depressed, showed fever and dehydration, has soiled perineum region with feces and greenish mucoid watery diarrhea. The EEDIE App-based disease diagnosis revealed in this case as coccidiosis (50.2%) and colibacillosis (46.6 %). During bacteriological analysis, *E. coli* was identified and oocysts were also observed from parasitic fecal floatation. Therefore, based on history, clinical findings, EDDIE and laboratory results, the case was diagnosed as clinical coccidiosis and enteric colibacillosis concurrently. The doe was treated promptly and vigorously with antibiotic, anticoccidial, IV fluid infusion, non-steroidal anti-inflammatory drug and supplemented by multivitamin injection. In conclusion, coccidiosis and colibacillosis are wasting and most economically important diseases of ruminants in Ethiopia. However, early diagnosis and prompt therapy with proper hygiene and good husbandry practices are the key to control and prevent these disease and their associated losses.

***Key words;*** *Coccidiosis and Colibacillosis, Diarrhea, Doe, Eimeria, E. coli*

## Introduction

Clinical coccidiosis and enteric colibacillosis, which are caused by protozoan parasite (*Eimeria*) and *Escherichia coli* bacteria respectively are economically important diseases and serious health problems that affect a wide range of farm animals and commonly cause death in young animals worldwide. They cause gastrointestinal disorders characterized by destruction of many intestinal cells, diarrhea, reduced condition, high morbidities and significant mortalities. These diseases can occur more often in intensive management conditions when animals are housed in confinement and overcrowding with poor sanitation due to the concentrating effects of both the host and the organism, extreme weather conditions and weaning (stress factors) (Keeton and Navarre, 2018; Delano *et al.*, 2012; Kusiluka *et al.*, 2016).

Ruminant coccidiosis is caused by protozoan parasite of *Eimeria* species which are host-specific (Keeton and Navarre, 2018) whereas colibacillosis is caused by *Escherichia coli* (gram negative, rod shaped, and facultative anaerobic bacteria) (Constable *et al.*, 2017). The *Eimeria* and *E. coli* are always present in the environment and small intestine (normal flora) of adult animals which are immune to clinical disease and most of the species of these microorganisms are harmless. However, some species of *Eimeria* including *Eimeria christenseni*, *E. arloingi*, *E. caprina*, *E. ovinoidalis* and *E. hirci* cause disease in goats in which *Eimeria arloingi* is the most pathogenic species (Aycan *et al.*, 2019; Taylor *et al.*, 2016) and strains of *E. coli* such as shiga toxin-producing *E. coli*, enterotoxigenic *E. coli*, enteroaggregative *E. coli*, enteroinvasive *E. coli*, enteropathogenic *E. coli*, and diffusely adherents *E. coli* are pathogenic and cause diarrhea in the host (Quinn *et al.*, 2016; Mohammed *et al.*, 2019).

These diseases can be transmitted through ingestion of contaminated water and food by pathogenic species or strains and direct or indirect contact with infected animals or person. The life cycle of coccidia is complicated and has many stages of development (21 days from oocytes to adult protozoa) whereas the incubation period of colibacillosis is 3-5 days and both *Eimeria* and *E. coli* multiply inside the epithelial cells of small intestine. Young animals, 1-4 months of age and two weeks of age are most susceptible for both *Eimeria* and *E. coli* respectively and adult animals develop clinical disease during stress that can result death (Sushma *et al.*, 2018; Constable *et al.*, 2017). In goats, both diseases cause significant enteric disease which can cause damage to epithelial cells of small intestine during growth and multiplication of the microorganisms that result diarrhea, inefficient weight gains and occasionally death (Wani *et al.*, 2013; Paul *et al.*, 2020).

The primary clinical sign of coccidiosis and colibacillosis is diarrhea that can contain blood or mucous and other signs include abdominal pain, loss of appetite and weight, fever, dehydration, depression, weakness, rough hair coat, rectal straining, convulsions and death (Shabana *et al.*, 2019; Taylor *et al.*, 2016). These diseases can be diagnosed based on history and clinical signs, microscopic examination of feces for oocysts in coccidiosis and isolation and identification of *E. coli* by bacterial culture, biochemical, molecular and serological tests in colibacillosis and post-mortem in both cases. Both coccidiosis and colibacillosis are differential to each other and other differentially diagnosed diseases include salmonellosis, parasitic gastro-enteritis and viral infections like corona and rota viruses (Kheirandish *et al.*, 2012; Constable *et al.*, 2017).

Treatment in both clinical coccidiosis and enteric colibacillosis consists specific antibiotic therapy with sulfa drugs that includes; sulfadimethoxine, sulfamethazine, sulfachlorpyridazine, trimethoprim-sulfamethoxazole, other broad-spectrum antibiotics (Papich and Mark, 2018) and antiprotozoal drugs used to treat coccidiosis include amprolium, decoquinate, monensin, lasalocid and fluid replacement therapy in both conditions can give better treatment outcome (Sykes and Papich, 2014; Gibbons *et al.*, 2016). Good husbandry practices, using feeds with coccidiostat, isolating infected animals and avoiding predisposing factors can prevent these diseases which cause huge economic losses in livestock industries (Khodakaram and Hashemnia, 2017; Sharif *et al.*, 2015). Therefore, the current case report describes the concurrent infection of clinical coccidiosis and enteric colibacillosis in the doe and its treatment outcome.

#### Description of the case

An adult local breed doe weighing 45kg was presented to VTH of AAU-CVMA, Bishoftu, on March 23/2021 with major complaints of loss of appetite, weakness and diarrhea for three days. The doe had a history of kidding two weeks prior to presentation. The owner has stated that the doe is kept in semi-intensive management system without any treatment and deworming for about one year and five months. He also reported that two other kids and a lamb had previously died of similar symptoms in the flock. Physical examination findings from the doe indicated, body temperature of 39.9 °C, respiratory rate of 24 breaths/minute, heart rate of 72 beats/minute with delayed capillary refill time and skin tent, pale and dry mucus membrane.

Clinical examination also revealed that the doe had poor body condition score, it was dull and depressed, febril and dehydrated, and presence of greenish-brown pasty fecal staining around the perineum region and well-formed feces covered with greenish mucoid discharge as indicated in figure 59 were observed. The EEDIE App-based disease diagnosis revealed in this case as coccidiosis (50.2%) and colibacillosis (46.6%), indicating that they are nearly concurrent infections. Therefore, based on history, clinical findings and EDDIE App-based result, the case was diagnosed as coccidiosis and enteric colibacillosis concurrently. Their differential diagnosis are salmonellosis, sudden ration change and other viral diseases.



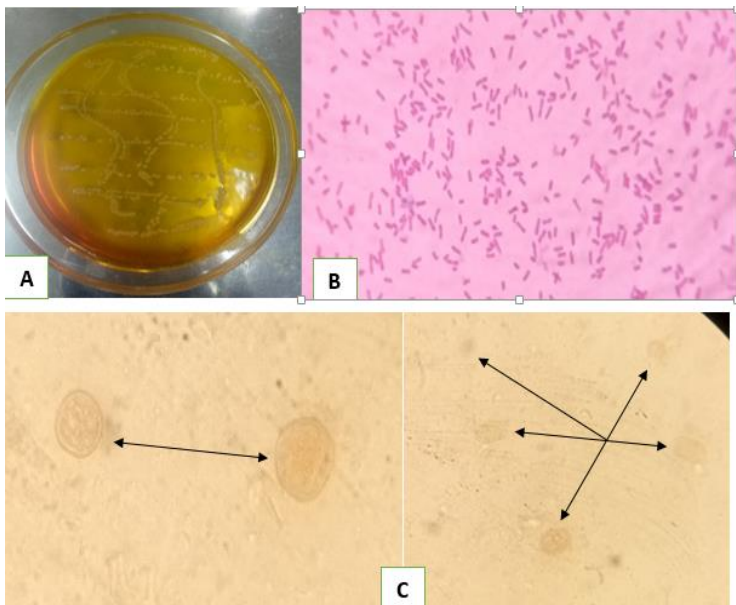
**Figure 59:** Picture of doe suspected with concurrent infection by coccidiosis and colibacillosis (**A**, indicates the doe with soiled perineum by diarrhea and **B**, greenish and mucoid watery diarrhea).

#### Laboratory investigation and its findings

Fecal sample was taken directly from the rectum of the doe and placed on tryptone soya broth in screw capped tube and clean universal bottle for bacterial isolation and parasitic demonstration respectively. Then, immediately transported to veterinary microbiology and parasitology laboratory of AAU-CVMA, Bishoftu. After enrichment and incubation at 37 °C overnight, some amount of the sample was inoculated on XLD agar medium followed by incubation at 37 °C for 24 hours. This grew *E. coli* with large, flat and yellow colonies (figure 60A). From XLD, the pure colony was taken and smear was prepared for gram staining that resulted red stained gram-negative rods by oil immersion (figure 60B).

For parasitological examination, 3 grams of fecal sample from universal bottle was taken and dissolved with 42ml of floatation fluid (magnesium sulphate) and processed by simple floatation technique to detect oocysts and nematode eggs. This resulted that, an ellipsoidal oocysts were observed under x40

magnification as indicated in figure 60C. Therefore, based on history, clinical signs, EDDIE App-based diagnosis and laboratory result, the diseases affecting the doe were confirmed as clinical coccidiosis and enteric colibacillosis concurrently.



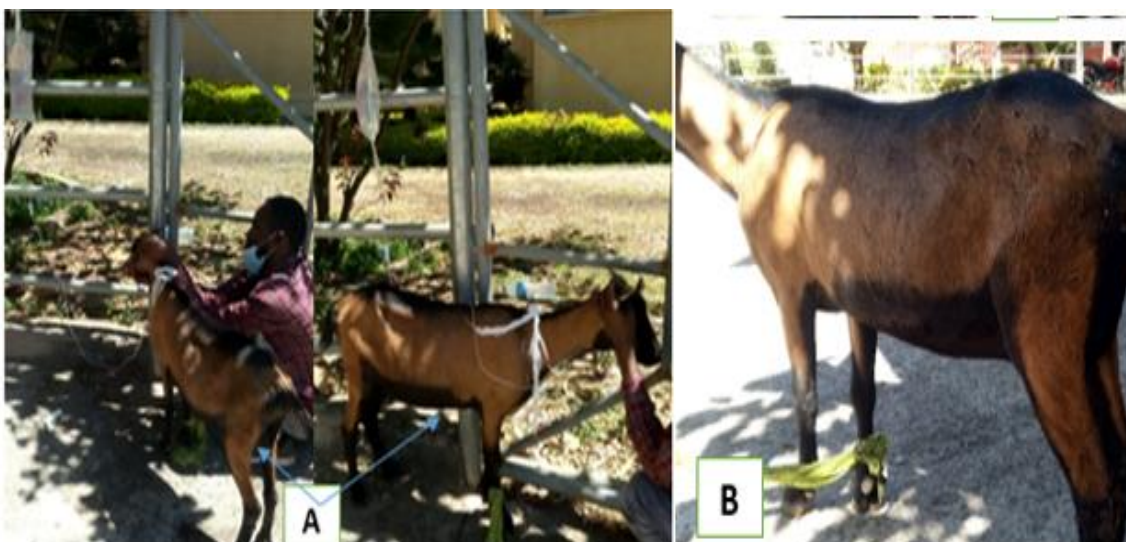
**Figure 60:** Laboratory results of coccidiosis and colibacillosis suspected doe (A, indicates growth of E.coli on XLD agar, B, gram staining of E.coli from XLD and C, oocysts from faecal floatation).

#### Case management and treatment outcome

The doe was medically treated by sulphamethoxazole-trimethoprim injection (Interchemie werken ‘De Adelaar’ B.V., Holland) at the recommended dose of 1ml/16kg body weight for five days twice daily for the first two days with 12 hours interval and once a day for the remaining three days intramuscularly, amprolium (corid) at a dose rate of 50mg/kg body weight once a day for five days orally with feed to reduce fecal shedding of *Eimeria* oocysts and a non steroidal anti-inflammatory dexamethasone sodium phosphate injection (Lincoln parenta Ltd, Gujarat, India) 1.5ml/50kg body weight IM for three days were used.

Additionally, intravenous infusion of lactated ringer’s solution with 40% glucose saline was administered for two days (figure 61A) to replenish dehydration and intramuscular multivitamins injection for thiamine deficiency as a result of amprolium administration were also used in the therapeutic regimen. The doe was constantly monitored during the treatment and diarrhea was stopped

after the second day therapy. After prompt and vigorous therapy, the doe showed clinical improvement and complete recovery was established after two weeks as the owner reported.



**Figure 61:** Picture of the doe during and after therapeutic management (A, indicates intravenous infusion of lactated ringer's solution with 40% glucose saline (left=1<sup>st</sup> day and right=2<sup>nd</sup> day) and B, showed status of the doe after fifth day therapy)).

## Discussion

Sheep and goat production in Ethiopia, especially in the central area is based on semi-intensive grazing system with combination of high stocking density and poor husbandry practice. This contributes to an increased incidence of infectious diseases (Demeke, 2020; Mohammed *et al.*, 2019). In case of coccidiosis and colibacillosis, such grazing and managing system give advantages to the deposition of oocysts and *E. coli* from either infected or carrier animals into the environment and vice versa that increases the infection of new susceptible animals (Bangoura, and Bardsley 2020).

*Coccidia* and *E. coli* are normally found in healthy adult goats and will not be considered as dangerous; however, if the number of oocyst per gram is greater than 20,000 (coccidiosis) and when predisposing factors like poor hygienic and husbandry practice, overcrowding, stress, food and water deprivation are found in the flock/herd or individual animal they become infectious and cause clinical coccidiosis and enteric colibacillosis (Shabana *et al.*, 2019; Young *et al.*, 2011; Firdaus *et al.*, 2016). This is in agreement with the current case report that the development of coccidiosis could be due to infection of the doe by colibacillosis that create favorable condition for oocysts to multiply when the immunity of

this doe become suppressed as the result of enteric colibacillosis which can be developed due to different predisposing factors.

Bacteria, protozoa, virus and fungals are few virulent microorganisms that may cause enteritis leading to diarrhea in newborn small ruminants than adults (Sushma *et al.*, 2018; Emily, 2021). In the current case, the isolated bacteria and protozoa were *E. coli* and coccidian oocysts which caused clinical coccidiosis and enteric colibacillosis in an adult doe. This indicates that colibacillosis and coccidiosis are the major causes of diarrhea with several common clinical signs including diarrhea, dehydration, weakness, abdominal pain with rectal straining, rough hair coat and weight loss in different age groups. However, this finding contrasts with others who stated that colibacillosis and coccidiosis affect kids and other newborns than adult animals which may be due to deficiency of immunoglobulins, multiple stresses, weaning and poor hygiene and nutrition (Wani *et al.*, 2013; Aycan *et al.*, 2019).

In the current case report, the doe was infected by enteric colibacillosis and clinical coccidiosis concurrently, therefore the clinical therapeutic and management protocol used was vigorous therapy by antiprotozoal amprolium selectively for coccidiosis, antibiotic sulphamethoxazole-trimethoprim, anti-inflammatory dexamethasone, multivitamin and supplementary therapy by lactated ringer's and 40% glucose solution which are effective for both enteric colibacillosis and clinical coccidiosis cases. So that, the doe has showed better therapeutic improvement and recovery. This approach agrees with other findings conducted by (Richard *et al.*, 2018; Sykes and Papich, 2014; Constable *et al.*, 2017; Taylor *et al.*, 2016) who stated that the primary therapeutic plan for animals infected by enteric diseases like colibacillosis, coccidiosis, salmonellosis and others including viral infections is usually with vigorous antimicrobial, anti-inflammatory and supportive therapy with fluids and others to reduce morbidity and mortality of animals.

In conclusion, coccidiosis and colibacillosis are wasting and most economically important diseases of ruminants in Ethiopia. However, early diagnosis and prompt therapy with proper hygiene and good husbandry practices are the key to control and prevent these diseases and their associated losses.

#### 4. OVERALL RESULTS AND DESCRIPTION OF THE CURRENT STUDY

A total of 20 different animal diseases comprised of 31 total animals were examined in this compiled case report through expert/clinician examination, EDDIE smart phone application as a diagnostic and treatment aid tool and laboratory confirmation and most of the diseased animals have recovered. From a total of 31 examined diseased animals 26 (83.9%) were recovered from the diseases, 1 (3.2%) animal was died and postmortem examination was conducted on 4 (12.9%) animals to identify the pathognomonic lesions of the disease in this case report as indicated from table 1 below.

**Table 1:** Total number of animals examined in relation to recovery rate, death and postmortem examination.

<b>Animals</b>	<b>Total</b>	<b>Recovered</b>	<b>Died</b>	<b>Passed for postmortem exam.</b>
Ruminants	25	24	1	0
Equine	1	1	0	0
Canine	1	1	0	0
Poultry	4	0	0	4
<b>Total (%)</b>	<b>31</b>	<b>26 (83.9%)</b>	<b>1 (3.2%)</b>	<b>4 (12.9%)</b>

From the total cases examined, the most frequent pathogens that caused the diseases were bacteria (35.5%) followed by parasites (29%), viruses (22.6%), protozoa (3.2%), metabolic (3.2%) and others (6.5%) in the study areas as indicated from table 2 below.

**Table 2:** Cases examined during the study in relation to etiologic agent in percentage.

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<b>Diseases</b>	<b>No of affected animals</b>	<b>Percentages(%)</b>
Bacteria	11	35.5%
Parasites	9	29%
Virus	7	22.6%
Protozoal	1	3.2%
Metabolic	1	3.2%
Others	2	6.5%
<b>Total</b>	<b>31</b>	<b>100%</b>

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From a total of 20 diseases, 77.5% cases were from Bishoftu town and its surroundings and 22.5% were from Modjo town and its surroundings. In relation to the disease with the etiologic agents in the study areas, 22.6% and 12.9% cases were due to bacteria, 22.6% and 6.4% were due to parasitic infection in Bishoftu and Modjo respectively, 22.6%, 3.2% and 6.5% were due to viruses, metabolic and others in Bishoftu while 3.2% were due to protozoa from Modjo as indicated from table 3 below. The variation in the number of cases and their causative agents in the two study areas was due to variation in the number frequencies of visit to those animal diagnostic and treatment facilities. The number of frequencies that was given to visit/ handle case in VTH was 75% and Modjo veterinary clinic was 25% during this study period. From this it could be concluded that, if equal frequency of visit can be given to both study areas for the diagnosis and treatment of animal diseases, the chance of handling and reporting cases can be nearly similar.

**Table 3:** Cases examined during this study in association of study areas and etiologic agents.

<b>Disease</b>	<b>No. of animals</b>	<b>Bishoftu</b>	<b>Modjo</b>	<b>Total cases(%)</b>
Bacteria	11	7 (22.6%)	4 (12.9%)	35.5
Parasites	9	7 (22.6%)	2 (6.4%)	29
Virus	7	7 (22.6%)	0	22.6
Protozoa	1	0	1 (3.2%)	3.2
Metabolic	1	1 (3.2%)	0	3.2
Others	2	2 (6.5%)	0	6.5
<b>Total</b>	<b>31</b>	<b>24 (77.5%)</b>	<b>7 (22.5%)</b>	<b>100</b>

In this study, smart phone based EDDIE (Ethiopia differential diagnosis and investigation center) application was also used as a diagnostic and treatment aid tool for animal disease diagnosis and it was evaluated and compared with expert/ clinician and laboratory diagnosis (table 4). A total of 18 different cases comprising 26 number of animals out of 20 cases (31 total animals) were diagnosed with this technology but 2 cases comprising 5 animals (4 hens and 1 dog) were not diagnosed by this method because it has no available data/information to diagnose these animal species. Therefore, from a total of 26 diagnosed cases (animals), both the EDDIE and clinician diagnosis were in agreement with 18 (68.2%) cases but they were not agreed in 8 (30.8%) cases. In relation to laboratory diagnosis, from 26 diagnosed cases 16 (61.5%) were agreed with laboratory confirmation but 10 (38.5%) diagnosed cases were not agreed.

Therefore, based on this study it can be concluded that smart phone based EDDIE application played significant role as an aid to diagnose and treat animals affected by different diseases, since it lists out differential diagnosis and treatment options (annex 4) for the corresponding selected disease. Hence, it is rated as good depending on this evaluation. As a new technology, it also improves complete, accurate and prompt diagnosis, treatment and reporting of livestock disease, however, application of this technology should be supported by further evaluation to use it through out the country.

**Table 4:** Evaluation of EDDIE App-based diagnosis with clinician/expert diagnosis and corresponding laboratory confirmation.

<b>Animal Spp.</b>	<b>No.</b>	<b>EDDIE diagnosis with clinician</b>		<b>EDDIE with laboratory confirmation</b>	
		<b>Agreed</b>	<b>Not agreed</b>	<b>Agreed</b>	<b>Not agreed</b>
<b>Bovine</b>	14	12	2	11	3
<b>Small ruminants</b>	11	5	6	4	7
<b>Equine</b>	1	1	0	1	0
<b>Total</b>	<b>26</b>	<b>18 (69.2%)</b>	<b>8 (30.8%)</b>	<b>16 (61.5%)</b>	<b>10 (38.5%)</b>

## 5. CONCLUSION AND RECOMMENDATIONS

This case study showed that different animal diseases caused by different pathogenic agents were occurred and examined from different species, ages and breeds of animals in VTH of AAU-CVMA, Bishoftu and Modjo Veterinary Clinic, Modjo, Ethiopia. The study also indicated that immediate and accurate diagnosing with thorough follow-up of the patient animals at animal health facilities is crucial to properly identify the diseases, and provide appropriate therapies which include medical, surgical, supportive and combination of them. This, further helps to the continuous control and prevention of different animal diseases to reduce the losses. In addition to clinician diagnosis, EDDIE App-based diagnosis was used and evaluated as a diagnostic and treatment aid tool, and it was found very significant but it lacks diseases data regarding poultry and canine species and didn't consider epidemiological data of the diseases. Even though, most animals in this study were recovered from the diseases with different drugs used during the study, drug sensitivity tests were not used to select the best one due to lack of available disks for those different drugs. Some of the diseases in the surrounding study areas need inpatient intensive follow-up, and other specialized diagnostic facilities in the animal health centers, especially at VTH, since different cases were presented as a referral from other clinics. Therefore,

- ✚ Veterinary extension program and regular training of animal health professionals and farmers should be practiced.
- ✚ Fully equipped and accessed laboratories with advanced diagnostic facilities should be established.
- ✚ Different antimicrobials and other supportive therapeutic drugs should be always available at animal health facilities.
- ✚ Smartphone App-based diagnosis should comprise diseases of all species with relevant epidemiological data, and further evaluation should be conducted.
- ✚ Antibiotic disks for drug sensitivity tests should be available and practiced.

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## 7. ANNEXES

### Annex 1: Addis Ababa University, CVMA case recording format.

DEBRE ZEIT

  
**ADDIS ABABA UNIVERSITY**  
**COLLEGE OF VETERINARY MEDICINE AND AGRICULTURE**  
**VETERINARY TEACHING HOSPITAL**

PATIENT CARD

Case No. \_\_\_\_\_ Date \_\_\_\_\_

NAME OF THE HOSPITAL:  VTH  DHWP/SPANIA CLINIC  FIELD: \_\_\_\_\_

Date of Admission \_\_\_\_\_ Date of Discharge \_\_\_\_\_

**ANIMAL DETAIL**

Species  Bovina  Ovina  Caprina  Felina  Canina  Swina  Avian  Equina

Breed \_\_\_\_\_ Measured/Estimated weight \_\_\_\_\_ Sex  Male  Female Age \_\_\_\_\_

Animal identification \_\_\_\_\_ Name /if any/ \_\_\_\_\_

**OWNER DETAIL**

Owners' Name \_\_\_\_\_ Address: Town \_\_\_\_\_ Kebele \_\_\_\_\_ House No. \_\_\_\_\_

Occupation: \_\_\_\_\_ Phone No. \_\_\_\_\_

**CASE HISTORY**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**CLINICAL FINDINGS**

Body Temp. \_\_\_\_\_ °C Respiratory rate \_\_\_\_\_ Breaths/min Heart rate \_\_\_\_\_ beats/min

Ruminal motility \_\_\_\_\_ /min Gut sound \_\_\_\_\_ VMM:  Normal  Pale  Congested  Jaundice  Cyanotic

CRF: \_\_\_\_\_

Body condition: \_\_\_\_\_ Superficial Ln: PF \_\_\_\_\_ PS \_\_\_\_\_ MND \_\_\_\_\_ RPH \_\_\_\_\_ Other \_\_\_\_\_

Description of other conditions \_\_\_\_\_

\_\_\_\_\_

**Organ/ System affected:**  Nervous  Musculo-skeletal  Respiratory  Circulatory  Digestive  Urogenital  Integument

Other (specify): \_\_\_\_\_

**SAMPLE TAKEN:**  Faeces  Blood  Skin scraping  Nasal swab  Vaginal swab  Ruminal content  Urine

Other \_\_\_\_\_

**DIFFERENTIAL DIAGNOSIS LIST:** \_\_\_\_\_

**LABORATORY RESULT:** \_\_\_\_\_

**TENTATIVE DIAGNOSIS:** \_\_\_\_\_

**DEFINITIVE DIAGNOSIS:** \_\_\_\_\_

*Prognosis* - - - - -

*Treatment* - - - - -

*Veterinarian in charge* - - - - -

*Follow up and status* - - - - -

### Annex 2: Clinical case handling protocols.

#### 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. Generally rectal temperature is recorded in animals by inserting the bulb of a clinical thermometer in the rectum, placed in contact of the rectal mucosae and keeping it for one to two minutes.

Normal reference values of animal body temperature (+/- 0.5°C) are as follow;

Horse =38,	Goat =39,	Cat =38.5
Cow =38.5,	Pig =39,	Rabbit =39.3
Sheep =39.5,	Dog =39	

### Recording of Pulse Rate

Usually the pulse rate is equal to the rhythmic contraction and expansion of heart. Increased pulse rate is common and occurs in most cases of septicaemia, toxæmia, circulatory failure, excitement and in pain stricken condition. Marked slowing of heart beat (bradycardia) is common in traumatic reticuloperitonitis in cattle.

#### *Site for Recording Pulse*

*Cattle*: Middle coccygeal artery, ventral coccygeal artery under the tail, facial artery, maxillary and median artery; femoral arteries (in case of calf).

*Dog*: Femoral artery on the inner side of thigh.

\* Normal pulse rate values (beats per minute) are as follow

Horse = 28-45,	Dog = 80-120,	Cow = 55-100,	Sheep/Goat = 60-110,	Rabbit =
20-150,	Cat = 100-140,	Swine = 60-120		

### Recording of Respiration Rate

In cattle average respiration rate per minute is 12-16. Variation occurs due to high ambient temperature, after exercise and it is normal. Respiratory rate is accelerated during fever and respiratory distress due to disease. Respiration rate should be noted when the animal is at rest. The type of respiration like costal, intercostal, abdominal, jerkey *etc.* are also to be noted. There is a ratio of 1:3 between respiration rate and pulse rate in healthy animals. Examination of respiration rate of animals is indicated for primary respiratory disease as well as secondary respiratory disease due to cardiac involvement, allergy and anaphylaxis.

### 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 colouration. 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 discolouration*: Signs of ecterus and hepatic disorder, jaundice.

- *Pin point/Petecheal haemorrhages*: Indicates septicaemia, surra, phosphorus and arsenic poisoning.
- *Cyanotic changes*: Bluish discolouration owing to dyspnoea, hypoxia, venous stasis, congestive cardiac failure, pleurisy, HCN and nitrate poisoning.
- *Ulcerations*: Typical ulcers on oral mucous membrane seen in FMD, PPR and RP.
- *Pinkish*: Equine infectious anaemia.

### Examination of Eyes

Ophthalmic examination gives some clues in diagnosing some diseases.

- *Sunken appearance*: Indicates chronic wasting disease and dehydration.
- *Pupillary reflex*: Loss of pupillary reflex and pupillary response to light are seen in toxemia and shock, poisoning and CNS disease.
- *Dilatation of pupil*: Seen in poisoning and shock.
- *Corneal opacity, ulcers*: Commonly occurs in mechanical injury or trauma. In canine it could also be due to canine distemper.

### Normal Colour of Conjunctiva of Various Animals

Cattle and Buffalo – Pale pink,            Horse – Pale roseate,    Sheep and Goat – Pale pink

Pig – Reddish tinged,                    Dog – Roseate,            Cat – Pale.

### Palpation

Consistency of an organ or tissues or a part of the body can be felt by lying hand with gentle pressure. Tips of fingers and flat of the hand are mostly used for handling the tissues or organs. When tissue appears firm, hard, solid like muscle, that could be a neoplasm (tumour). When structure appears bone like consistency – it could be the exostosis or ossification of cartilage. Hot and painful swelling, hard or soft could be the abscess (hard in initial stage, soft in maturity/ripened abscess).

- *Doughy* – Where soft tissues retain finger points, or causes pits on pressure – oedema and impaction of rumen.
- *Cold and painless (fluctuating)* – could be the cyst distended with gas (bloat), distended with food (impaction), distended with fluid (ascites), crepitating sound (Black Quarter or Subcutaneous emphysema). Abnormalities of abdominal and urogenital organs can be felt by rectal palpation.

### Percussion

Striking of any part of the body with a short, sharp blow that enables underlying organs to vibrate and generate an audible sound is called percussion. Drum like sound audible from rumen indicates tympanitis, dull resonance in impaction. Hyper resonant sound is observed while the lungs are filled

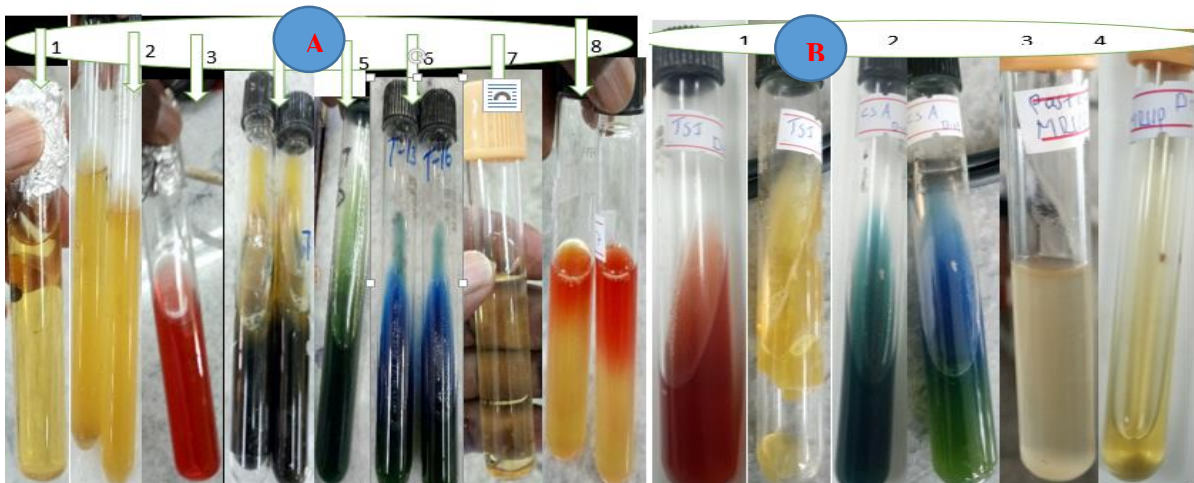
with excessive air. Increased amount of gases will emit tympanic sound in abdomen. This method is useful in small animals than the large animals.

### Auscultation

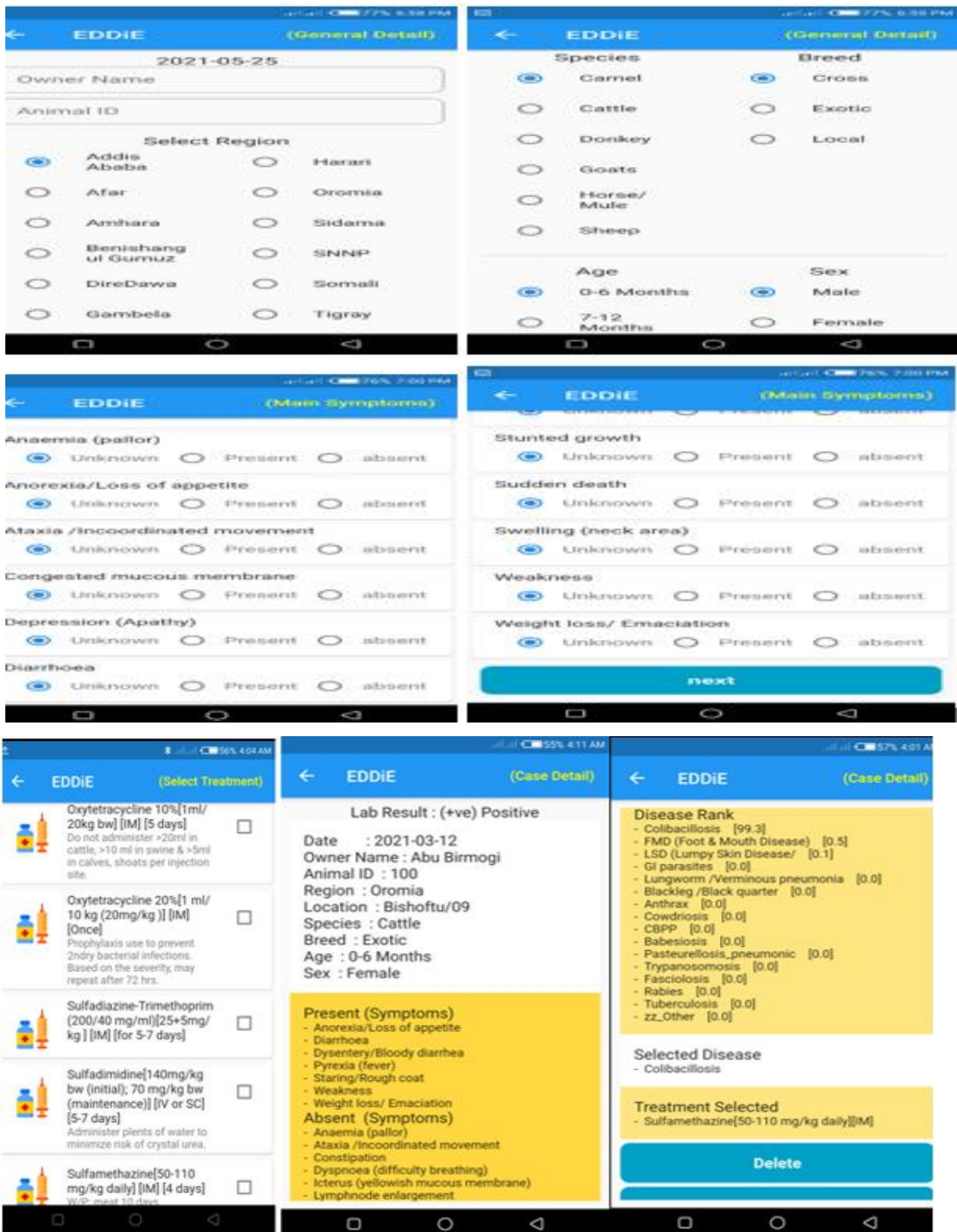
It means listening of various functional sounds produced by some thoracic and abdominal organs by use of stethoscope for ascertaining the pathological condition of lungs, pleura, heart and certain parts of alimentary tract. It is useful for hearing peristaltic sounds during ruminal and intestinal contractions, listening sounds produced in course of normal functioning of trachea and lungs (dry rales in congestion and moist rales in exudation), cardiac sounds like cardiac murmurs in valvular disease, splashing sounds in pericarditis and hydro pericardium.

**Annex 3:** Biochemical laboratory results of some of the bacteria from the cases.

3.1. Biochemical results of Salmonella (A) with corresponding negative controls from the ox and Mannheimia (B) from sheep. Key: 1. TSI, 2. CSA, 3. SIM, 4. MR-VP.



**Annex 4:** Form of smart phone based EDDIE Application as disease diagnosis and treatment aid.



Finally the smart phone EDDIE App based disease diagnosis provides detail of the case just like this.