CLINICAL CASE REPORTS ON ANIMAL DISEASES AND EVALUATION OF EDDIE SMARTPHONE BASED MOBILE APPLICATION AS A DIAGNOSTIC AID TOOL IN BISHOFTU AND MODJO TOWNS, CENTRAL ETHIOPIA

MVSc THESIS

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Clinical Case Reports on Animal Diseases and Evaluation of EDDIE Smartphone Based Mobile Application as a Diagnostic Aid Tool in Bishoftu and Modjo Towns, Central Ethiopia

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DEDICATION

I dedicate this MVSc thesis to my parents whose love, understanding and sincere support gave me the inspiration to complete the work.

STATEMENT OF THE AUTHOR

First, I declare that this thesis is my own original work and has not been presented for a degree in any University and that all sources of materials used for this thesis have been correctly acknowledged. This thesis has been submitted in partial fulfilment of the requirements for an advanced (MVSc) degree at the Addis Ababa University and is deposited at the University Library to be made available to borrowers under rules of the Library. Brief quotations from this thesis are allowable without special permission provided that accurate acknowledgement of source is made. Requests for permission for extended quotation from or reproduction of this manuscript in whole or in part may be granted by the head of the major department or the Dean of the School of Graduate Studies when in his or her judgment the proposed use of the material is in the interests of scholarship. In all other instances, however, permission must be obtained from the author.

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ABBREVIATIONS AND ACRONYMS

AAU	Addis Ababa University
CBPP	Contagious Caprine Pleuropneumonia
CSA	Central Statistical Agency
CVMA	College of Veterinary Medicine and Agriculture
EDDIE	Ethiopia differential diagnosis and investigation center
FMD	Foot and Mouth Disease
HS	Hemorrhagic septicaemia
LSD	Lumpy Skin Disease
ND	Newcastle Disease
PPR	Peste Des Petits Ruminants
UTI	Urinary Tract Infection
VTH	Veterinary Teaching Hospital

ABSTRACT

Ethiopia has the highest livestock population in Africa and ranks 10th globally. However, animal disease is one of the bottle neck leading to a significant economic losses in the sector. Central Ethiopia, particularly Bishoftu and Modjo towns are among the areas affected by animal diseases. This study was undertaken to study and report cases of diseases in animals presented to animal health facilities in Bishoftu and Modjo towns between October 2020 to March 2021 and November 2022 to May 2023, and evaluate the Ethiopia differential diagnosis and investigation center (EDDIE) smartphone-based mobile application as a veterinary diagnostic aid tool. The study used a descriptive case study design and purposive sampling to include animals from different species. Case reports followed protocols including history taking, physical and clinical examination, and EDDIE app as a diagnostic aid tool, laboratory investigation, case management, follow-up, and discussion. Cattle accounted for 35% (7/20) of the reported cases in the study, sheep for 30% (6/20), goats for 5% (1/20), horses for 5% (1/20), chicken for 15% (3/20), and dogs for 10% (2/20). Tentative and laboratory diagnoses revealed that viruses caused 25% (5/20) of the diseases, bacteria 25% (5/20), parasites 25% (5/20), metabolic disorders 10% (2/20), unknown causes 10% (2/20), and foreign bodies 5% (1/20). Of the 20 cases, 75% (15/20) recovered, 10% (2/20) died, and 10% (2/20) underwent post-mortem examination. EDDIE app diagnosed 15 cases (7 cattle, 6 sheep, 1 goat, and 1 horse) but doesn't support poultry and canine diseases. The app correctly matched a confirmatory diagnoses in 8 cases, relatively matched in 2 cases, mismatched in 2 cases, and couldn't diagnose 3 cases (disease not registered on the app). Generally, the study provides valuable insight into animal diseases in the study area and the efficacy of the EDDIE app as a diagnostic aid tool. Therefore, it is recommended that veterinary practitioners in the study area and beyond should make early diagnosis and treatment of animal diseases using suitable tools like EDDIE. Research and development of EDDIE app should continue to improve its accuracy in diagnosing diseases and expand its coverage to more animal species. Additionally, appropriate measures, including training and support, should be put in place to help prevent and control animal diseases in the study area, and beyond.

Keywords: *Animal Disease, Case reports,EDDIE App, Bishoftu, Modjo, Ethiopia*

1. INTRODUCTION

The livestock sector plays a vital role in the economy of Ethiopia, which has the highest livestock population in Africa and ranks 10th globally (Asresie *et al*., 2015). The country is estimated to have about 70 million cattle, 42.9 million sheep, 52.5 million goats, 2.15 million horses, 10.8 million donkeys, 0.38 million mules, and 57 million poultry population (CSA, 2021).

Livestock is a major source of animal protein, power for crop cultivation, means of transportation, export commodities, manure for farmland and household energy, security in times of crop failure, and means of wealth accumulation (Mekuriaw and Harris, 2021). According to the World Bank (2017), in 2017 the sector made up up to 40% of the agricultural Gross Domestic Product (GDP), nearly 20% of the total GDP, and 20% of the country's foreign exchange earnings.

However, despite the huge potential, animal diseases are a major constraint that limits the development of the sector, causing significant economic losses. Animal diseases affect the health and welfare of the animals, increasing mortality, reducing productivity, and lowering the quality of animal products such as milk, meat, and hides. Furthermore, animal diseases pose significant risks to public health as some diseases, such as Brucellosis, can be transmitted from animals to humans (Mekuriaw and Harris, 2021)..

Central Ethiopia, East Shewa zone, which include Bishoftu and Modjo towns, are one the areas affected by animal diseases. The zone is estimated to have 1.1 million cattle, 445,120 sheep, 431,649 goats, 13,114 horses, 4,762 mules, 292,307 donkeys, and 859,616 poultry (CSA, 2021). Bishoftu and Modjo are a major towns in the zone with potential livestock development area. Some of the commonly reported animal diseases in the area include Haemorrhagic Septicemia, Pastuerellosis, Foot and Mouth Disease (FMD), Lumpy Skin Disease, Contagious Caprine Pleuropneumonia (CBPP), Peste Des Petits Ruminants (PPR), Coccidiosis, and Newcastle Disease (ND)(Chere *et al*., 2022; Mohammed *et al*., 2022).

Generally, there are various factors that contribute to high prevalence of animal diseases in the country, including poor animal husbandry, inadequate veterinary services, inadequate vaccination coverage, and introduction of new diseases (Mekuriaw and Harris, 2021). In addition, Inadequate disease control measures, including lack of awareness, limited resources, and weak veterinary services, have contributed to the persistent challenge of animal diseases in Ethiopia, including Bishoftu and Modjo towns(Asefa *et al.*, 2019).

This necessitates, the need to study the prevalent diseases, and understand their clinical presentation to develop effective diagnostic, treatment protocols, and control strategies.

Moreover, Early and precise diagnosis of animal diseases is critical to improving animal health and detecting outbreaks of diseases. However, the current approach of disease diagnosis in animal health facilities in Ethiopia, including those found in Bishoftu and Modjo towns depends on individual veterinarian's tentative diagnoses, which may lack accuracy due to the absence of laboratory facilities and financial constraints for confirmatory diagnosis. As a result, in such a limited diagnostic facilities, an effective and efficient approach is necessary to improve disease diagnosis (Beyene *et al*., 2017).

Recently, the application and use of Smartphone based mobile application as a disease diagnostic aid tool has been more generally explored in the field of public health care (Boulus *et al*., 2014). Such tools and services have been proposed as a means to substantially improve animal disease diagnostic service in developing countries. EDDIE is one of the smartphone based mobile app developed to aid animal disease diagnosis in resource limited settings, but few detailed field based trials have been reported (Beyene *et al*., 2017).

Therefore, this study was undertaken with the objectives of:

General objective

- To study and report cases of diseases in animals presented to animal health facilities in Bishoftu and Modjo towns between October 2020 to March 2021 and November 2022 to May 2023, and assess the EDDIE smartphone-based mobile application as a veterinary diagnostic aid tool.

Specific objectives

- To study and produce case reports of diseases in animals presented to animal health facilities in Bishoftu and Modjo towns, during the study periods.
- To assess EDDIE smartphone-based mobile application as a veterinary diagnostic aid tool.
- To provide appropriate recommendations based on the findings of the study.

2. MATERIAL AND METHODS

2.1. Study Area

Bishoftu town is located in the East Shewa zone of the Oromia region in the central highlands of Ethiopia at 8°45′ North latitude and 38°59′ East longitude. The town is located in tepid to cool sub-moist mid-highland at an altitude of about 1,920 meters above sea level. It is located about 45km southeast of the capital, Addis Ababa. The average minimum and maximum temperature range from 10.9 to 27.0°C with a mean value of 18.9°C. The town has an average annual rainfall of 686.9mm and average relative humidity of 60.0% (NMSA, 2005). AAU-CVMA, professor Fiseha G/ab veterinary teaching Hospital and SPANA equine Hospital are among the animal health facilities found in Bishoftu town.

Modjo town is located in the East Shewa zone of the Oromia region, Ethiopia at 66 km Southeast of Addis Ababa and lies at 8°35'N and 39°7'E at an altitude 1790 mas (Fig. 4). The area gain rainfall twice a year those known as long and short season rainy season. The main rainy season extends from June to September. The average annual rainfall, temperature, and mean relative humidity are: 776mm, 19.4 0C and 59.9%, respectively (NMSA, 2005).

There is no official statistical report of animal population in both Bishoftu and Modjo towns, but according to CSA (2021), animal population of East shewa zone, which include Bishoftu, Modjo and other towns not included in this study is estimated at 1.1 million cattle, 445,120 sheep, 431,649 goat, 13,114 horses, 4,762 mules, 292,307 donkeys, 859,616 poultry (CSA, 2021). Modjo veterinary clinic is one of the animal health facility found in Modjo town.

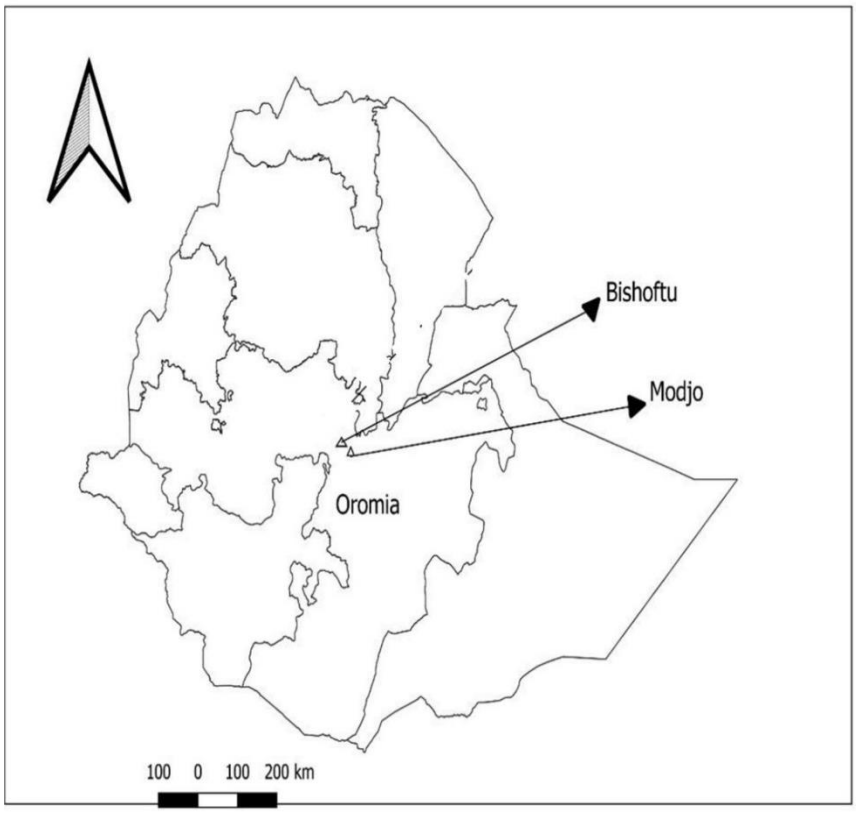

Figure 1 Map of Ethiopia showing the study areas, drawn by using QGIS Software

2.2. Study Design and Study Population

The study employed a descriptive case study design and utilized purposive sampling technique to include animals presented in animal health facilities. Animals from various species, such as bovine, equine, ovine, caprine, poultry, and pets that were presented to animal health facilities in Bishoftu and Modjo towns between October 2020 to March 2021 and November 2022 to May 2023 were studied and reported.

2.3. Case Handling Protocols

To handle data of the cases, a veterinary clinical case recording format of Addis Ababa University, CVMA, a clinical case handling protocol described by Jana and Ghosh (2013), and Constable *et al*. (2017) were used as shown in (Annex 1 and 2).

2.3.1. History Taking

History serve as the main source of information for veterinary clinicians in identifying the presence of disease problems. Hence, it is essential to gather precise and comprehensive anamnesis through the owner for accurate disease diagnosis. The process of obtaining history should include patient data, immediate and past history, and information about the management and environment. These factors were thoroughly evaluated when taking the case history, providing appropriate direction for animal examination. (Constable *et al*., 2017).

2.3.2. Physical and General Examination

Every presented animal underwent a visual evaluation of their physical, behavior, posture, gait, superficial skin wounds, uterus/vagina prolapse (if female), signs of salivation, nasal discharges, abdominal distension, and signs of locomotor dysfunction. Different body parts and systems were evaluated through palpation, percussion, auscultation, needle puncture (when needed), and walking of the animals. The animal's temperature, heart rate, pulse, and respiratory rate were also documented. Regardless of their age, all livestock underwent clinical assessment based on their disease history, owner's complaints and observed symptoms to diagnose diseases and disorders.

2.3.3. EDDIE Smart Phone Diagnosis and Laboratory Investigation

Apart from standard procedures, mobile applications based on smartphones were utilized for diagnostic purposes, and laboratory testing was conducted to confirm individual cases. A diagnostic tool, called Ethiopia differential diagnosis and investigation center (EDDIE) software, which functioned on smartphone technology. It recorded data on animal species (excluding poultry and pets), clinical signs, disease and treatment for each specific disease.

Based on the recorded data provided by the mobile app, diagnosis of the disease were conducted, followed by the administration of appropriate treatment. Evaluation of the smartphone-based EDDIE results was compared with laboratory results to assess its effectiveness in diagnosing diseases.

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3. COMPILED CASE REPORTS

3.1. Case Reports on Bovine

3.1.1. *E. Coli*-Induced Hematuria: The Case of Urinary Tract Infection in a Bull

3.1.1.1. Abstract

Blood in the urine, also known as hematuria, is one of the clinical symptoms of a urinary tract infection in cattle. The origin of hematuria can be grouped into Pre-renal, renal, and post-renal causes. This case report presents a six year-old bull brought to the Addis Ababa University, College of Veterinary Medicine and Agriculture, Veterinary Teaching Hospital, on December 24, 2020 with a history of hematuria. The bull was diagnosed with a urinary tract infection caused by *E.coli.* On physical and clinical examination, the bull was found to have mild dehydration, bloody urine, a pale mucous membrane, depression, fever, increased heart and respiratory rates, and a weak pulse. The case was diagnosed in the laboratory using urine centrifugation, bacterial culture of urine, geimsa staining, and, PCV determination. The results of the tests showed sedimentation of RBC in the urine (hematuria), anaemia, and the presence of *E. coli* in the urine, indicating hematuria caused by urinary tract infection. EDDIE app also diagnosed the case as a urinary tract infection. The bull was treated with Oxytetracycline for three days to manage the urinary tract infection, as well as supportive care by multivitamins. After three days of treatment, the bull's clinical signs improved, and hematuria stopped. The findings suggest that early and appropriate treatment of UTIs can lead to positive clinical outcomes for the affected animal.

Key words: *Hematuria, Urinary tract infection, Bull, Culture, E.Coli, Treatment*

3.1.1.2. Introduction

Blood in the urine, also known as hematuria, is a typical clinical symptom of a urinary tract infection in cattle (Camara *et al*., 2009). Pre-renal, renal, and post-renal causes of hematuria can all be broadly divided into three groups. Conditions that have an impact on the kidneys' blood supply, such as hypotension, shock, and dehydration, are examples of pre-renal causes of hematuria. These circumstances can cause ischemia, which in turn damages the renal tubules and causes blood to leak into the urine (Constable *et al*., 2017).

Hematuria has renal causes that are connected to kidney diseases like glomerulonephritis, pyelonephritis, and neoplasia. Glomerulonephritis, a common cause of hematuria, is characterised by glomeruli inflammation, which may result in blood leakage into the urine. Hematuria can also be a symptom of pyelonephritis, an infection of the kidneys that damages and irritates the renal tubules. Hematuria can also result from neoplasia, or kidney tumours, because they interfere with regular renal function (Mueller, 2007).

Hematuria has conditions like urolithiasis, cystitis, and neoplasia as post-renal causes, which affect the urinary tract after the kidneys. Because urinary tract irritation and damage result from urolithiasis or the presence of urinary stones, hematuria can result. Cystitis, or bladder inflammation, can cause hematuria as a result of blood leakage from the inflamed bladder wall. Due to the disruption of regular urinary tract function, neoplasia of the urinary tract can also result in hematuria (Parah *et al*., 2013).

Depending on the underlying cause, the clinical symptoms of hematuria in cattle can vary. Hematuria might not be accompanied by other symptoms like anorexia, lethargy, or weight loss in some cases, but it might also be the only clinical symptom in others. The colour of the urine can also vary, ranging from pink to red to brown, depending on the severity of the bleeding (Gheini *et al*., 2017).

Clinical signs, physical examination, and diagnostic testing are used to make the diagnosis of hematuria in cattle. Anaemia symptoms such as pale mucous membranes and a rapid heartbeat can be detected through physical examination. A urinalysis, complete blood count, serum biochemistry, and imaging tests like ultrasound or radiography are some examples of diagnostic testing. The results of additional tests, such as bacterial culture and sensitivity testing, biopsy, or cytology, may be required to determine the underlying cause of the hematuria. Toxic plants and bacteria are frequently associated with hematuria in cattle. The most common bacterial species that cause hematuria due to urinary tract infection are Corynebacterium *renale*, Staphylococcus, and Streptococcus (Yeruham *et al.,* 2006; Floeck, 2007).

Hematuria in cattle is primarily treated by supportive therapy like fluids, nutritional support, and pain control. Antibiotics may be used to treat any underlying bacterial infections.

In severe cases, blood transfusions may be necessary to manage anaemia. Treatment of the underlying cause of the hematuria depends on the confirmatory diagnosis of the cause of the disease and the location of the pathologic condition in the animal's body (Yanenko *et al*., 2006).

Disease prevention methods that reduce the risk of urinary tract infections can be used to prevent hematuria in cattle. This may involve vaccination, biosecurity precautions, a healthy diet, and adequate housing. Identifying and managing any underlying conditions that might cause hematuria can also be aided by routine veterinary care and monitoring (Besser *et al*., 2003).

Although hematuria is a frequently encountered clinical condition in animals, it is not well reported (Yeruham *et al.*, 2006). Moreover, according to my knowledge, the syndrome frequently occurs in cattle in Ethiopia, and its diagnosis usually involves only a tentative diagnosis. This might be due to limited diagnostic settings to confirm the case. In this case report, the diagnosis and successful treatment of hematuria resulting from a urinary tract infection by E. coli in a 7-year-old adult bull were presented.

3.1.1.3. Case description

A 6-year-old red and dark local breed bull weighing about 250 kg was presented to AAU-CVMA-, Professor Fiseha G/ab VTH, from the Kality peasant association, Ada'a district, on December 24, 2020, with a history of bloody urine for the past two days. The bull was reared extensively with other animals and fed on communal grazing land. On physical examination, the bull had mild dehydration, a pale mucous membrane, depression, a high temperature (38.4 °C), an increased heart rate (82/min), a weak pulse, an increased respiratory rate (24/min), red urine, normal rumen motility.

Based on the history and clinical findings, the case was tentatively diagnosed as unidentified hematuria. In addition, EDDIE app diagnoses results showed Babesiosis, 50.5%, UTI, 45.5%, and Enzootic hematuria, 10.1%. Then, lists of causes of the condition, including bacterial urinary tract infections, bracken fern poisoning, urolithiasis, neoplasia, trauma, leptospirosis, and babesiosis, were listed as possible differential diagnoses.

a) The presented bull b) Bull's bloody urine c) The recovered bull, day 3

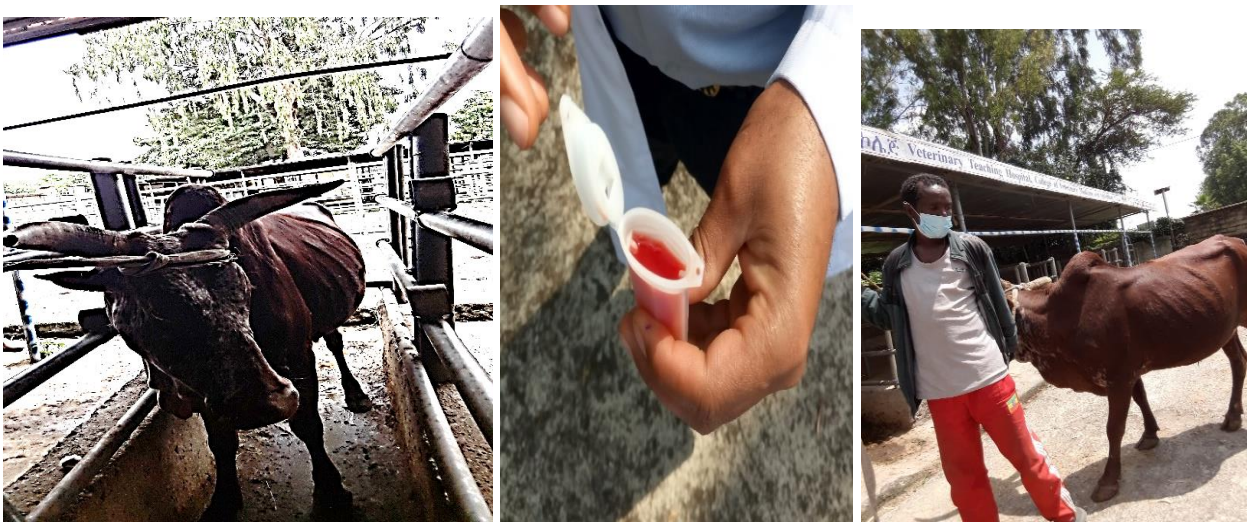

Figure 2 A bull with hematuria

3.1.1.4. Laboratory investigation and findings

To confirm the case, blood and urine samples were collected, and different laboratory tests were conducted in the veterinary parasitology laboratory of the AAU-CVMA. The urine sample was subjected to centrifugation at 5000 rpm for five minutes to identify the presence of blood (hematuria) or haemoglobin (hemoglobinuria). In addition, physical examination (colour and content), and geimsa staining of urine were performed. The blood sample was used for the PCV test, Giemsa stain, manual RBC count by hemocytometer, and manual haemoglobin determination by Salli's apparatus.

Centrifugation of urine resulted in sedimentation of RBC, indicating the presence of blood (hematuria). A physical examination of the urine showed bloody urine. A Giemsa stain of urine revealed the presence of debris (epithelial cells), RBC, and unknown gram-negative bacteria.

Blood tests showed a PCV of 24%, a 7.8 g/dl haemoglobin concentration, 3.7 x 10^6 /µL RBC number, a 6 fl, MCV, and a 32.5, MCHC value. The Giemsa stain of blood was negative for blood parasites and had mature RBCs. These all indicate macrocytic hyperchromic anaemia.

a) Hematuria (arrows) **b**) PCV result (24%) (arrow) **c**) Giemsa stain of blood smear (no parasite)

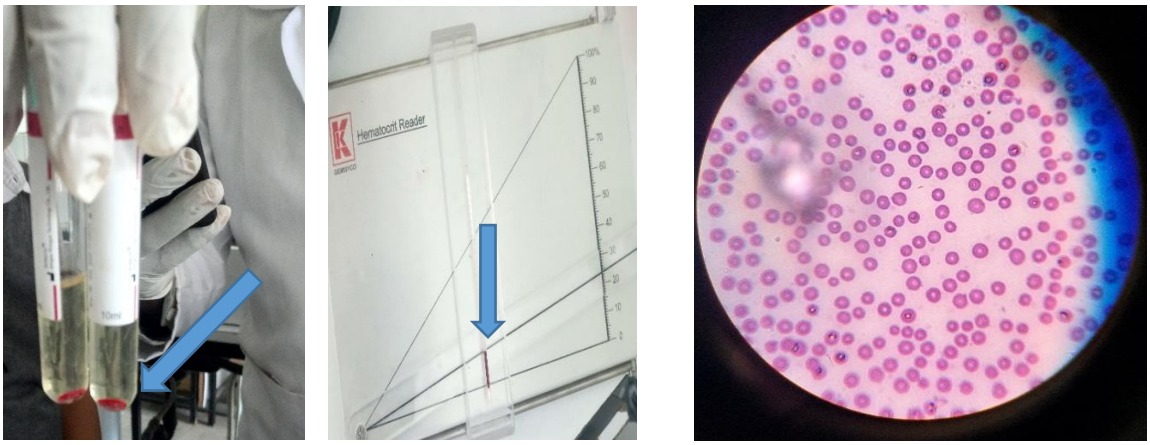

Figure 3 Laboratory findings of the case of a bull with hematuria

Based on the results, hematuria that might be due to an upper urinary tract infection was diagnosed, and its cause was identified by the bacterial culture of a urine sample. 1ml of urine sample was collected and 0.5ml of it was poured into 9ml of enrichment media (nutrient broth), while 0.5 ml was poured into 9ml of enrichment media for Salmonella (Rappaport broth) to rule out Salmonella (salmonella grow on Rappaport). Then, incubated at 37 °C for 24hrs. On the following day, the enriched urine samples were checked for growth. No growth was seen on Rappaport (ruled out Salmonella), while cloudiness (increased turbidity) of nutrient broth was seen. A loop full of enriched urine samples in nutrient broth was then cultured on sorbitol McConkey agar and incubated at 37 °C for 24hrs. After 24 hours of incubation, growth was observed on the sorbitol McConkey. The growth from the sorbitol McConkey agar was subcultured on nutrient agar medium and EMB (Figure 4). The next day the, gram's staining was performed from the pure culture on the nutrient agar. Finally, it was concluded based on the growth patterns and Gram‟s stain results that the bacterium responsible for the urinary tract infection was *E.coli*.

3.1.1.5. Case management and treatment outcome

Treatment was initiated with antibiotics, Oxytetracycline 10% (Shanghai Thongren Pharmaceutical Co., Ltd., China) at a dose of 1 ml per 10kg, IM, per day for 3 days to manage the urinary tract infection, as well as supportive care by multivitamins (centre-vitamins, Aether

Centre (Beijing) Biology Co., Ltd., China) at a dose of 20 ml per adult animal. After three days of treatment, the bull's clinical signs improved, and hematuria stopped.

a) *E.coli* on McConkey agar b) E. coli on EMB agar c) gram stain of *E.coli*

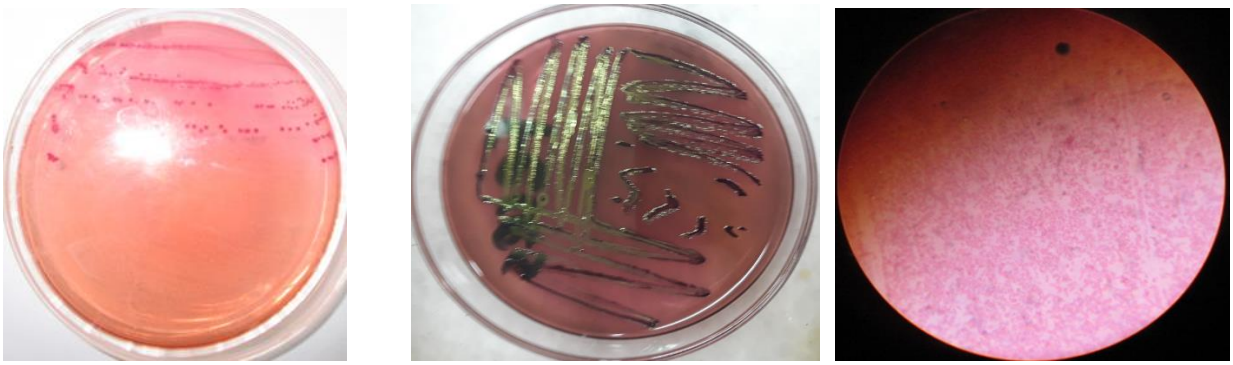

Figure 4 *E. coli* culture and gram stain

3.1.1.6. Discussion and Conclusion

Hematuria, a common clinical sign in animals with urinary tract infections, is characterised by the presence of blood in the urine. Urinary tract infections in cattle occur sporadically and can lead to infections in the lower urinary tract, such as cystitis, or in the upper urinary tract, such as pyelonephritis. The bacteria Escherichia coli are commonly associated with either upper or lower urinary tract infections (Yeruham *et al*., 2006; Prescott *et al*., 2022).

In this case report, the successful treatment of hematuria in a 6-year-old adult bull, which was definitely diagnosed with a urinary tract infection caused by E. coli, was presented. To diagnose the case, first, a history was taken, followed by a physical examination and a laboratory diagnosis. According to the owner, red-coloured urine and depression were identified as the chief complaints for bringing the bull to be treated. The physical examination of the bull showed clinical signs of red-coloured urine, depression, mild dehydration, pale mucous membrane, depression, fever, increased heart and respiratory rate, and a weak pulse. Moreover, it was identified that the red urine seen was occurring from the middle to the end of micturition. These signs are in agreement with previous studies (Yeruham *et al*., 2006; Smith, 2015; Constable *et al*., 2017) that have reported similar signs in animals with UTI. However, reports by Yeruham et al. (2006), and Braun *et al*., (2008) have included additional signs like abdominal pain, frequent

urination, and straining to urinate, which were not observed in this case report. This might be due to differences in the severity of the disease in different cases.

Based on the history and clinical findings, the case was tentatively diagnosed as unidentified hematuria, and lists of causes of the condition, including bacterial urinary tract infections, bracken fern poisoning, urolithiasis, neoplasia, trauma, leptospirosis, and babesiosis, were listed as possible differential diagnoses. This is in agreement with reports by Abutarbush *et al*. (2000) and Constable *et al*. (2017).

To reach a confirmatory diagnosis, laboratory investigation of the case involved urine centrifugation to identify whether it was haematuria or hemoglobinuria; giemsa staining to diagnose blood parasites; urine culture to identify the presence and type of bacteria that may cause UTI infection; and a PCV test to know the level of anaemia in the animal. This is in agreement with Braun *et al*. (2008) and Constable *et al*. (2017). However, reports by Braun *et al*. (2008) have included the use of ultrasonography to aid the diagnosis, particularly the location of UTI disorders. In this case, ultrasonography was not used due to a lack of equipment.

Urine centrifugation resulted in the sedimentation of RBC in urine, showing the condition as hematuria. This result was more supported by the physical examination, which showed that red urine was occurring from the middle to the end of micturition. Because hemoglobinuria almost always produces a uniform red discoloration of urine throughout micturition. With these results, diseases with clinical signs of hemoglobinuria (Babesiosis, Anaplasmosis, Bacillary Hemoglobinuria, and Leptospirosis) were ruled out. Ruling out babesiosis and anaplasmosis was supported more by giemsa staining, which showed the absence of parasites in blood. This is consistent with (Hopkins, 1987; Yeruham *et al*., 2006; Constable *et al*., 2017).

In addition, bacterial cultures of urine showed the presence of E. coli, which may indicate an UTI caused by E. coli bacteria. This is in agreement with studies by Yeruham *et al. (2006)* and Braun *et al*. (2008), which reported *E. coli* as the most common cause of UTI with hematuria in cattle. This result ruled out enzootic hematuria, and UT neoplasia. In addition, the sporadic occurrence of the case may support the decision to rule out enzootic hematuria. Because enzootic hematuria mostly occurs in groups and is not sporadic.

Finally, the cause of hematuria in this case was confirmed as a urinary tract infection by E. coli. This is because UTIs caused by E. coli can lead to inflammation and damage to the lining of the bladder or urethra, which can result in hematuria.

Since ultrasonography or other equipment was not used to identify the source of the bleeding, it was guessed as originating from an upper UTI because of the red urine occurring from the middle to the end of micturition. In this case, the EDDIE smartphone application identified UTI as the top two diagnoses for the case. This indicates almost the matching of the app and confirmatory diagnosis.

The treatment of urinary tract infections with clinical signs of hematuria in animals involves the use of antibiotics to eliminate the causative agent. In addition, supportive care with multivitamins and fluids may be necessary to manage the clinical signs and prevent dehydration (Bicalho *et al*., 2012). Hence, the use of oxytetracycline (antibiotics) and multivitamins, in this case in agreement with (Yeruham *et al*., 2006; Constable *et al*., 2017).

Recovery, the treatment outcome in this case report is consistent with Yeruham *et al*. (2006) and Braun *et al*. (2008). This might be due to early treatment of the disease. This treatment outcome has supported the decision to rule out enzootic hematuria and UT neoplasia. Because enzootic hematuria and UT neoplasia cannot be treated and give a quick recovery with antibiotics.

In conclusion, this report describes a case of E. coli-induced UTI in a bull presented with clinical signs of hematuria. It highlights the importance of early diagnosis and management of UTIs to prevent and control hematuria in animals. In addition, more investigation of the disease is recommended to establish effective prevention and control of the disease, particularly in Ethiopia, where diagnostic facilities are limited.

3.1.1.7. References

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3.1.2. Coccidiosis in an Ox

3.1.2.1. Abstract

Coccidiosis is a parasitic disease caused by protozoan parasites of the genus Eimeria. The disease commonly affects young cattle aged between four and twelve months. Cattle of all ages, including adults, are susceptible to coccidiosis, but young calves are more frequently affected. This case report describes a 7-year-old ox diagnosed with coccidiosis at the Addis Ababa University, College of Veterinary Medicine and Agriculture, Professor Fiseha G/ab Veterinary Teaching Hospital, Bishoftu, Ethiopia on November 20, 2020. The animal was presented with decreased feed intake, weight gain, and ploughing ability, accompanied by depression, blood-stained feces, increased heart and respiratory rates, a weak pulse, and poor body condition. However, temperature of the ox was in normal limit. The EDDIE smartphone application diagnosed the case as gastrointestinal parasites. Laboratory examination of feces by floatation technique revealed the presence of Eimeria oocysts (8 oocyst per field), and no parasite was observed in the blood smear, indicating coccidiosis as the cause of the disease. The ox recovered from the disease after being treated with antibiotics (sulfadimethoxine for five days), antiparasitics (ivermectin, stat), and supportive therapy (multivitamin). In this case report, though the EDDIE app diagnosis and confirmatory diagnosis were related, the app didn't accurately diagnose the case as coccidiosis, which might be due to the rare occurrence of the disease in adult cattle. Hence, this result highlights the necessity of including coccidiosis in the differential diagnosis of adult animals showing symptoms consistent with the disease. Generally, through the efficient diagnosis and treatment of infected animals with coccidiosis, positive outcomes can be achieved, as seen in this case.

Key words: *Coccidiosis, Ox, Floation Technique, EDDIE, Sulfadimethoxine, Ethiopia*

3.1.2.2. Introduction

Coccidiosis is intestinal tract disease of cattle caused by protozoan parasites of the genus Eimeria. It causes significant economic losses due to reduced weight gain, decreased milk production, and increased mortality (Daugschies, 2005; Dubey 2019).

Coccidiosis is one of the most important parasitic diseases affecting calves in several regions of Ethiopia with reported morbidity and mortality rates as high as 67% and 20%, respectively (Abebe *et al*., 2008; Yadessa, 2014; Ibrahim *et al*., 2016).

Thirteen Eimeria species that cause coccidiosis have been identified in the feces of cattle worldwide from which only three *(E. zuernii, E. bovis, and E. auburnensis*) are pathogenic and associated with clinical diseases (Dubey 2019). In Ethiopia, More than six Eimeria species have been identified, and *Eimeria bovis*, *Eimeria zuernii*, and *Eimeria auburnensis* are the most common one (Gebeyehu *et al*., 2018; Tamrat *et al*., 2020)

Coccidiosis has a multi-stage pathogenesis. Oocysts, which are excreted in the feces of infected animals, are the disease's main mode of transmission. After the oocysts are ingested, sporozoites are released and enter the host's intestinal cells. The sporozoites undergo asexual reproduction, resulting in the formation of merozoites. The merozoites then invade other intestinal cells, causing destruction of the intestinal lining. This leads to inflammation, diarrhea, and dehydration. The destroyed intestinal cells release oocysts, which are shed in the feces of the infected animal. This completes the life cycle of the parasite (Daugschies & Najdrowski, 2005; Bangoura & Bardsley, 2020).

Cattle with coccidiosis may have clinical symptoms such as dehydration, appetite loss, weight loss, and greenish or bloody diarrhea. The number of oocysts ingested, the animal's age and immune condition, and the existence of other concurrent diseases all affect the severity of the disease’s clinical symptom. In severe cases, coccidiosis can be fatal (Keeton *et al*., 2018; Bangoura & Daugschies, 2019).

Oocysts found in fecal samples are the basis for the diagnosis of coccidiosis. Floatation technique is the most commonly used test to detect Eimeria oocysts in feces of affected animal. Molecular methods like polymerase chain reaction (PCR) can be used to identify the species of Eimeria. (Taylor 2000; Dubey, 2019).

Anticoccidial medications like sulfadimethoxine, amprolium, and toltrazuril are used to treat coccidiosis. The severity of the illness and the age of the animal determine which medication is best. The management of coccidiosis requires supportive therapy, which includes the administration of fluids and electrolytes (Jonsson *et al*., 2011; Sudhakara *et al*., 2015).

Good hygiene and sanitation procedures, as well as access to clean water and food, are necessary for the prevention and control of coccidiosis in cattle. Coccidiosis vaccines are also available in some countries, but their eficcacy varies depending on the species of Eimeria and the age of the animal (Keeton *et al*., 2018; Bangoura & Daugschies, 2019).

Cattle of all ages, including adults, are susceptible to coccidiosis, but young calves are more frequently affected (Dubey, 2019). Coccidiosis in adult cattle has only been reported in a very small number of cases worldwide (Sudhakara *et al*., 2015; Waruiru *et al*., 2000; Sivajothi & Rayulu, 2013). Furthermore, there is no previous reports on the occurrence of coccidiosis in adult cattle in Ethiopia. The clinical symptoms, diagnosis, and treatment of coccidiosis in a seven-year-old ox in Bishoftu, central Ethiopia were thus reported in this case. The occurrence of the disease in adult cattle emphasizes the necessity of considering the disease in the differential diagnosis of adult animals showing similar symptoms.

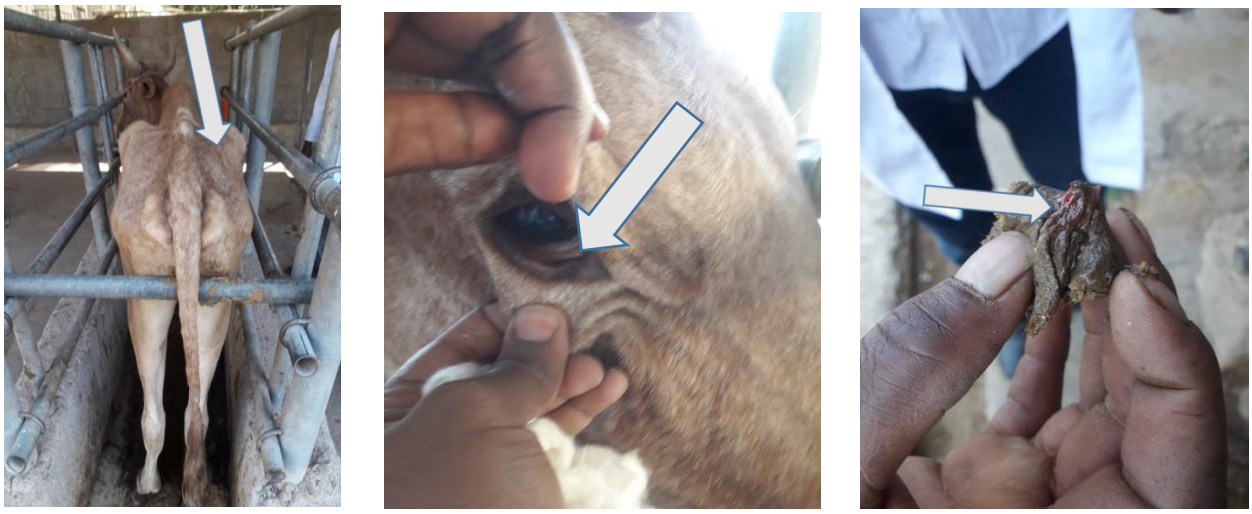
3.1.2.3. Case Description

On November 20, 2020, a 7-year-old local breed ox weighing approximately 180 kg was brought to Addis Ababa University, College of Veterinary Medicine and Agriculture, Professor Fiseha G/ab Veterinary Teaching Hospital (AAU-CVMA, Professor Fiseha G/ab VTH) , Bishoftu, Ethiopia, from Kality peasant association, Ada'a district. The ox had a history of decreased feed intake, weight gain, and ploughing ability, as well as diarrhoea, for the past two weeks. It was from the Bishoftu animal market a month prior and was kept extensively. The ox grazes on communal grazing land along with other animals. The owner reported that he was unaware of the ox's previous history of disease, medication, and vaccination.

Upon physical examination, the ox had depression, an increased heart rate (76/min), an increased respiratory rate (24 breaths/min), and a weak pulse. Furthermore, the ox had increased capillary refill time (>2 seconds), poor body condition (body condition score 2), a rough hair coat, blood-stained feces, intermittent diarrhoea, a sunken eyeball, and a pale mucus membrane) as shown in

(Figure 5). However, rectal temperature (37.1 °C), and all other areas and systems appeared normal.

Based on history and clinical signs, my tentative diagnosis was unidentified GIT parasites. EDDIE app also diagnosed the case as GIT parasites, and a differential diagnosis including Salmonellosis, colibacillosis, and bovine viral diarrhoea was listed.

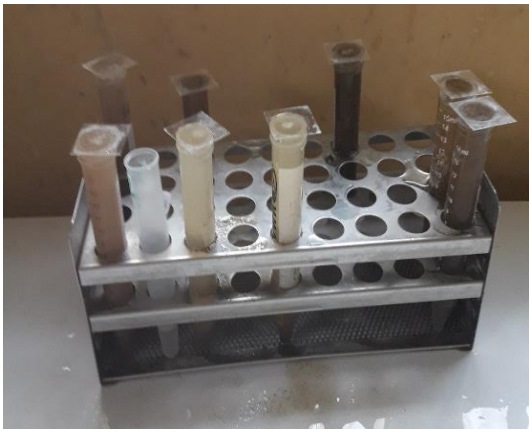


a) Poor Body condition b) Sunken eye ball and pale mucous membrane c) blood stained feces

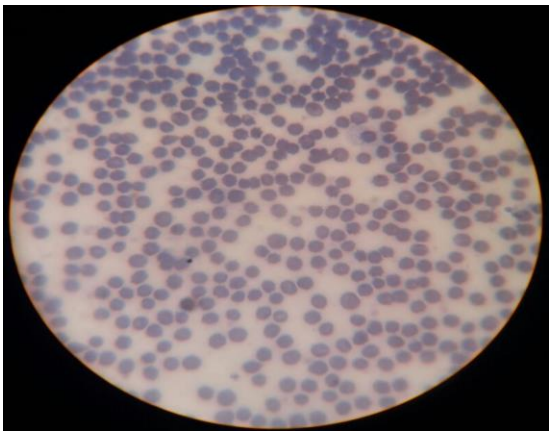
Figure 5 Clinical signs of coccidiosis observed in ox

3.1.2.4. Laboratory Investigation and Findings

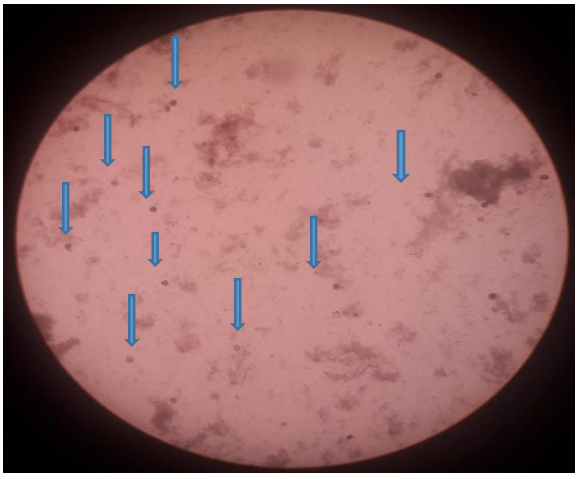
To confirm the case, feces and blood samples (from ear vein) were collected and processed at Parasitology laboratory of Addis Ababa University, College of Veterinary Medicine and Agriculture (AAU-CVMA), Bishoftu. The fecal examination was conducted using direct smear, simple floatation (Figure 6a), and sedimentation techniques, while the blood test was performed using Giemsa stain and PCV test. Eimeria oocysts were detected in the fecal examination (by simple floatation test (Figure 6, c and d). The Giemsa stain of the blood showed negative results (Figure 6b), for protozoal parasites. The PCV test revealed a 23% value, indicating that the animal is suffering from a mild anemia. Finally, based on the above results, the case was confirmed as coccidiosis.



a) Simple floation test



b) Giemsa stain of blood smear with no blood parasite



c) Eimeria oocyst observed under microscope (40x) d) Magnified Eimeria oocyst (400x)

Figure 6 Laboratory tests and findings of Coccidiosis case

3.1.2.5. Case Management and Treatment Outcome

Initially, the animal was treated empirically with broad-spectrum antibiotics (Sulfadimethoxine, Chengdu Qiankun Veterinary Pharmaceutical Co., Ltd., China) at a dosage of 1 ml per 10kg for five days, as well as an anti-parasitic medication (Ivermectin, Sheyang Sunvictotor Pharmaceutical Co., Ltd., China) administered subcutaneously at a dose of 0.2mg per kg stat.

Additionally, as a supportive therapy, multivitamins (centre-vitamins, Aether Centre (Beijing) Biology Co., Ltd.'s, China) at a dose of 20 ml per animal, IM, stat, were administered prior to laboratory confirmation of the disease. After the disease was confirmed as coccidiosis, the initial treatment with sulfadimethoxine was continued for 5 days.

On follow-up, after the third day of treatment, the animal's appetite improved and its feces returned to a normal colour. The animal also became more active during that time. Moreover, after a month, the animal had returned to its full normal state with good body condition.

3.1.2.6. Discussion and Conclusion

Coccidiosis is a common parasitic disease in cattle caused by Eimeria species (Dubey, 2019). In this case report, an adult ox of 6 years old was diagnosed with coccidiosis at AAU-CVMA, Professor Fiseha G/ab VTH, based on laboratory findings. The ox showed signs of depression, including an increased rectal temperature, increased heart and respiratory rates, a weak pulse, increased capillary refill time, poor body condition, a rough hair coat, blood-stained faeces, a sunken eyeball, and a pale mucus membrane. Laboratory investigations revealed the presence of Eimeria oocysts in the faeces and mild anaemia.

Coccidiosis is one of the most important parasitic diseases affecting young calves in several regions of Ethiopia, with reported morbidity and mortality rates as high as 67% and 20%, respectively (Abebe et al., 2008; Ibrahim *et al*., 2016; Yadessa *et al*., 2016). However, coccidiosis can sometimes occur in adult animals, especially those with weakened immune systems or those exposed to high levels of the parasite (Dubey, 2019). In this case, the disease occurred in an adult animal, which might be due to weakened immunity or a high parasitic burden on the animal. Therefore, it is important to consider coccidiosis as a differential diagnosis in both young and adult animals presenting with clinical signs consistent with the disease.

According to Dubey (2019) and Constable *et al*. (2017), clinical signs of coccidiosis in cattle include diarrhoea, anorexia, weight loss, dehydration, and anaemia.

The clinical signs observed in this case report are consistent with several reports on coccidiosis in Ethiopia (Abebe *et al*., 2008; Yadessa *et al*., 2016).

The diagnosis of coccidiosis in this case report was based on history, physical examination, the EDDIE app diagnosis, and laboratory diagnosis by faecal and blood tests. The positive result for Eimeria oocysts in the faeces and mild anaemia (24% PCV result) confirmed the diagnosis as coccidiosis. This is in agreement with Constable *et al*. (2017), and reports by Keeton *et al*. (2018; Bangoura & Daugschies (2019). However, Constable et al. (2017), Dubey (2019), and reports by Keeton *et al*. (2018); Bangoura & Daugschies (2019) have included the use of morphologic

characterization and the PCR method for more identification of the Eimeria species causing the disease. Those methods were not used in this case due to a lack of resources. In this case report, though EDDIE app diagnosis (GIT parasite) and confirmatory diagnosis (coccidiosis) were related, the app didn't accurately diagnose the case as coccidiosis, which might be due to the rare occurrence of the disease in adult cattle

In this case, the tentative diagnosis and the confirmatory diagnosis did not match. Though salmonellosis was diagnosed as a tentative diagnosis in the case, a confirmatory diagnosis by laboratory investigation revealed coccidiosis. This indicated the importance of listing differential diagnoses during disease diagnosis in animals. Though bacterial cultures were not performed, the high infestation of the animal by Eimeria parasite in this case showed the high possibility of the signs caused by coccidiosis, but there might be concurrent infection with bacteria (Salmonellosis and colibacillosis) or virus (BVD), which need further investigation.

The treatment of coccidiosis in this case report involved the use of sulfadimethoxine and multivitamins as supportive therapy. The animal responded well to the treatment, and the clinical signs resolved within a few days. The outcome of this case is consistent with reports by Sudhakara *et al*. (2015) and Hazarika and Das (2018), which have reported successful treatment of coccidiosis with sulfadimethoxine and supportive therapy like multivitamins.

In conclusion, this case report highlights the occurrence of coccidiosis in ox in Ethiopia and the importance of a thorough clinical examination and diagnostic testing in the diagnosis and treatment of the disease. Therefore, coccidiosis should be considered a potential differential diagnosis in adult cattle with diarrhoea, anaemia, dehydration, blood-stained faeces, and weight loss symptoms.

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3.1.3. Hemorrhagic Septicemia in an Ox

3.1.3.1. Abstract

Hemorrhagic septicaemia is a bacterial disease of cattle caused by *Pasteurella multocida*. This case report describes a six-year-old crossbreed ox that was diagnosed with HS. The ox was presented to the Addis Ababa University, College of Veterinary Medicine and Agriculture, Professor Fiseha G/ab Veterinary Teaching Hospital on February 17, 2021 with a history of depression, inappetence, and coughing for two days. It had no history of recent illness, vaccination status, or trauma, but the owner informed that an unknown injection was given to the animal, which had improved its body condition about two months ago. Physical examination revealed fever, congested mucous membranes, and increased heart and respiratory rates. Based on the animal's history and clinical signs, the ox was tentatively diagnosed with Hemorrhagic septicaemia. EDDIE app also diagnosed the case as Hemorrhagic septicaemia. Samples of nasal swabs and feces were collected to confirm the diagnosis by bacterial culture. The result of the culture revealed Pasteurella multocida, causative agent for HS. Treatment was initiated with oxytetracycline antibiotics at a dose of 10mg/kg for four consecutive days. The ox's clinical signs improved, and it returned to its normal state in about one week. This case report highlights the importance of prompt diagnostic investigations and management to manage HS, which can cause significant economic losses in the livestock industry. It also revealed that EDDIE app was accurate to diagnose the disease in an ox. The cattle owners are advised to prevent the disease by vaccination, and early veterinary care for their animal.

Key words: *Hemorrhagic Septicaemia, Ox, Clinical Signs, Bacterial Culture, Treatment*

3.1.3.2. Introduction

Hemorrhagic septicaemia (HS) is a common bacterial disease that affect livestock, including cattle. The disease is caused by *Pasteurella multocida* that affects both humans and animals. In cattle, the disease cause septicemia, pneumonia, and even death (Blackall and Bojesen, 2010).

Hemorrhagic septicaemia is a prevalent bacterial disease in cattle worldwide. Stress, overcrowding, and poor ventilation are the common risk factors associated with the disease. Cattle of all ages and breeds are susceptible to the disease, but young and immunocompromised animals are more susceptible. Direct contact with sick animals or contaminated food, water, or equipment are two ways the disease can be spread (Smith, 2014).

Pasteurella multocida is a gram-negative bacterium that produces a variety of virulence factors, including lipopolysaccharides, capsule, and toxins. The bacterium colonize the upper respiratory tract of cattle and result in respiratory disease, or it may enter the bloodstream and result in septicemia. The host immune response plays a crucial role in the pathogenesis of the disease, as both humoral and cellular immunity are involved in the clearance of the bacterium (Carter and Chengappa, 2013).

Diagnosis of HS in cattle can be challenging, as the clinical signs are non-specific and laboratory tests are required. Bacterial culture and sensitivity testing are the gold standard for diagnosis, but they can take several days to obtain results. Other diagnostic tests include serology, polymerase chain reaction (PCR), and histopathology (Shivachandra *et al*., 2011; Cortese *et al*., 2012).

The use of antibiotics like penicillin, amoxicillin, and enrofloxacin is the treatment for pasteurellosis in cattle. The choice of antibiotic depends on the sensitivity of the bacterium and the severity of the disease. Supportive care, including fluid therapy and nutritional supplementation, are also important for the management of HS (Prescott and Baggot, 2013).

Prevention of HS in cattle involves improving management practices, such as reducing stress and improving ventilation, and vaccination. Vaccines are available for the prevention of disease, but their efficacy varies depending on the strain of Pasteurella multocida and the vaccination protocol (Tapdasan and Salces, 2016).

HS commonly affect young animals of 2 months upto 2 years old, but it can also affect adult animals under stress condition.

The case fatality rate of the dsease typically approaches 100% unless the animal is treated very early; few animals survive once they become visibly ill. Hence, this case report was conducted for the purpose of describing the early diagnostic, treatment, and treatment outcome of HS in an ox at AAU-CVMA, Professor Fiseha G/ab VTH, Bishoftu, Ethiopia.

3.1.3.3. Case desciption

A six year-old cross breed ox weighing about 280 kg was presented to AAU-CVMA, Professor Fiseha G/ab VTH, on February 17, 2021 with a history of depression, inappetence, and coughing for the past two days. The ox was reared extensively on communal grazing land and housed a night with other four cattle, consisting of two cows, one calf, and one ox. The ox had no recent history of illness, vaccination, and trauma. However, the owner said that "the ox was given an injection drug he couldn't remember, that had improved the body condition of the ox two months ago.

Up on physical examination, the ox was found to be depressed and febrile, with a rectal temperature of 39.9 °C, congested mucous membranes, and increased heart (68 beats/min) and respiratory rate (32 breaths/min). There were excessive salivation, lacrimation, serous bilateral nasal discharges, and diarrhoea were also appreciated.

Based on the history and clinical findings, the case was tentatively diagnosed as Haemorrhagic septicaemia. EDDIE app also diagnosed the case as HS.

3.1.3.4. Laboratory investigation and findings

For confirmatory diagnosis of the case, samples of nasal swab and feces were collected and processed at the Microbiology and Parasitology laboratory of Addis Ababa University, College of Veterinary Medicine and Agriculture, Bishoftu. For the swab sample, a deep nasal cavity swab was taken after disinfecting the skin around the noses with 70% ethyl alcohol. For the fecal sample, feces was collected from the rectum of the animal using a hand covered by glove and transferred to a 10ml fecal container tube. Floatation and sedimentation technique were conducted on fecal sample to identify the presence or absence of parasite egg and both the tests showed negative result. The collected swab was transported using tryptose Soya broth and incubated at 37 ^{o}C for 24hrs. Meanwhile, blood agar and MacConkey media were prepared and incubated at 37 ^{o}C for 24hrs for identification of the sterility of the prepared media.

After 24 hours, a loop full of the broth cultures were streaked over both MacConkey agar and blood agar medium and incubated at 37 ^{o}C for 24 hours.

Accordingly, a small mucoid colony with smooth edge, round, greyish, and non-haemolytic with odour were identified on blood agar. But, there was no growth of bacteria seen on MacConkey agar. In addition, a Gram stain was used to identify gram reaction and shape of the bacteria grown on blood agar and found short rod gram-negative bacteria. Moreover, pure colony growth on sheep blood agar plates was sub cultured on nutrient agar and incubated at 37 ^{0}C for 24 hour for use in secondary biochemical test. Secondary biochemical test was conducted using Sulfide-Indole-Motility (SIM) medium and catalase test.

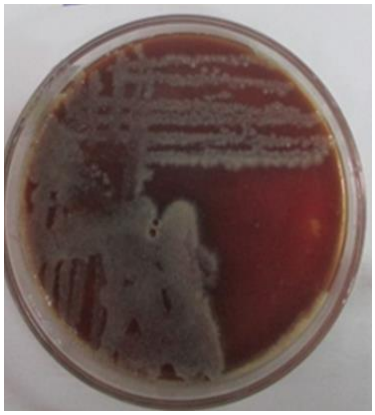
Pure colony of pastuerella from nutrient agar was inoculated into prepared SIM media and incubated at 37 °C for 24 to 48 hours. To test for indole production, 5 drops of Kovács reagent was added directly to the tube. A positive indole test was indicated by the formation of a pink to red color in the reagent layer on top of the medium within seconds of adding the reagent. To test for catalase test, small amount of pure colony from nutrient agar was placed onto a clean microscope slide by using plastic loop. A few drops of H_2O_2 were added onto the smear and mixed. A positive result was shown on bubbling. The result of secondary biochemical test showed non motile bacteria, with positive result for catalase and indole test, and negative for M.R and V.P tests (Figure 7). Based on history, clinical signs, and laboratory findings, the case was confirmed as Hemorrhagic septicaemia.

3.1.3.5. Case management and treatment outcome

Treatment was initiated with antibiotics, 10% oxytetracycline (Shanghai Thongren Pharmaceutical Co., Ltd, China) at a dose of 10mg/kg (1ml/10kg/day) for consecutive four days, IV (the first day) and then IM, q.d. for three days. Over the course of the three days, the initial treatment continued because of the correct diagnosis and treatment. According to the owner, the ox's clinical signs improved and recovered to normal state in one week.

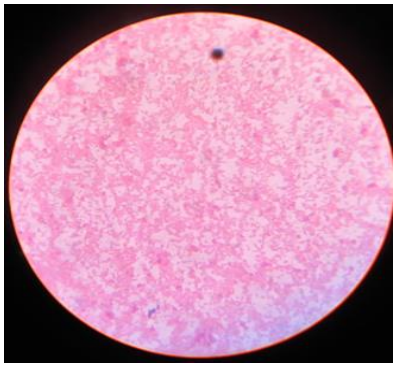
*a)*presented bull

b)nasal discharge



c)P. multocida on blood agar

d) catalase test positive



e) Gram –ve *E.coli*

f) Indole positive

Figure 7 presented bull and laboratory findings of Hemorrhagic septicaemia

3.1.3.6. Discussion

Hemorrhagic septicemia is a fatal disease of cattle caused by the bacteria Pasteurella multocida. It is a highly contagious respiratory and systemic disease that causes acute septicemia, with sudden onset and high morbidity and mortality rates in cattle (Blackall and Bojesen, 2010).

In Ethiopia, the disease is common in cattle, and its diagnosis is often tentative based on history and clinical symptoms due to limited laboratory diagnostic settings. This case describes the physical, clinical, and laboratory diagnosis and treatment for hemorrhagic septicemia disease in a six-year-old ox presented to AAU-VTH.

According to the owner, depression, inappetence, and coughing were identified as the chief complaint for bringing the ox to the clinic. The Physical and clinical examination of the ox showed the clinical signs of depression, inappetence, coughing, fever, congested mucous membranes, increased heart and respiratory rates, excessive salivation, lacrimation, serous

bilateral nasal discharge, and diarrhea. These clinical signs are consistent with the clinical signs of HSD described in literature and reports (Shivachandra, 2011; Smith, 2014; Constable *et al*., 2017; Feyisa, 2018). However, reports by Feyisa (2018), and literature by Constable *et al*. (2017) have included additional signs like neck and brisket edema, and abscesses, which were not observed the in this case. This might be due to differences in the severity or duration of the disease in cases.

To confirm the case, laboratory investigation was conducted using samples of nasal swab in bacterial culture for identification of the causative agent. In addition, the secondary biochemical tests were performed. Based on the results, HSD was confirmed. The diagnostic approach used in this case, parallels that of literature and reports (Mitra *et al*., 2013; Tapdasan *et al*., 2016; Feyisa, 2018). It also revealed that EDDIE app was accurate to diagnose HS in ox.

However, in this case, in addition to nasal swab, feces were collected and floatation and sedimentation technique were conducted on to identify the presence or absence of concurrent infection with GIT parasite.

The treatment for septicemic pasteurellosis is antibiotics, and literatures suggest using broad-spectrum antibiotics such as 10% oxytetracycline with initial IV and then IM administration, Constbale *et al*. (2017), which was the same to treatment protocol used in this case. Recovery from the disease within a week was treatment outcome seen in this case report, this is in line with Constable *et al.* (2017) which says that early treatment of HSD can result in recovery even within two days. However, report by pilapil (2020), resulted in death of the affected animals, despite treatment. This might be due to difference in treatment protocol, severity of the disease, care by owners, and immunity status of the animal.

In conclusion, appropriate diagnosis, and early and appropriate antibiotic therapy can result in successful treatment outcome of HSD in cattle. The disease can be prevented by improving management practices, such as reducing stress and good ventilation, and vaccination.

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3.1.4. Lumpy Skin Disease in an Exotic Breed Cow

3.1.4.1. Abstract

Lumpy skin disease is a viral disease caused by the lumpy skin disease virus (LSDV) that affects cattle, resulting in declining milk production, weight loss, and decreased fertility. This case report describes Lumpy skin disease diagnosed exotic breed cow that was brought to the Addis Ababa University, College of Veterinary Medicine and Agriculture, Veterinary Teaching Hospital on January 5, 2021, with skin nodules, decreased feed and water intake, and reduced milk production. The animal's physical examination revealed hard nodules on the head, neck, and back, swelling of both prescapular and prefemoral lymph nodes, along with fever, an increased heart rate, and respiratory rate. Lumpy skin disease was tentatively diagnosed based on the history and clinical findings. EDDIE app also diagnosed the case as Lumpy skin disease. To confirm the diagnosis, two biopsy samples of nodules were analysed in the laboratory by PCR test and the result of the test was positive for Lumpy skin disease, indicating EDDIE app diagnosis and definitive diagnosis are matched, indicating EDDIE app's accuracy in diagnosing Lumpy skin disease in cattle. The cow was treated with oxytetracycline to prevent secondary bacterial infections, along with multivitamins for supportive therapy. The owner was advised to provide adequate shelter, avoid exposure to flies, isolate the cow from other healthy animals, and providing a soft feed and concentrate, along with an adequate water supply. Following treatment, the cow became active with a good appetite within four days, and the nodules disappeared with scar formation a month after treatment. This case report highlights that early diagnosis and treatment are needed for effective management and prevention of the spread of Lumpy skin disease in cattle.

Key words: *Lumpy Skin Disease, EDDIE App, PCR, Treatment*

3.1.4.2. Introduction

Lumpy skin disease virus (LSDV) is a causative agent of lumpy skin disease (LSD), a viral disease that affects cattle. The disease is characterized by the formation of nodules or lumps on the skin. LSD cause significant economic losses due to decreased milk production, weight loss, and decreased fertility (Molla *et al*., 2017).

Lumpy skin disease virus (LSDV) is a member of the Capripoxvirus genus. The virus is closely related to the sheep pox and goat pox viruses, which can also cause illnesses in their respective hosts (Tulman *et al*., 2002).

Lumpy skin disease (LSD) in cattle is caused by a complex interaction between the environment, the host immune system, and the virus. Through the skin or mucous membranes, the virus enters the host and replicates in the nearby lymph nodes. This causes the host immune system to become activated, which releases a number of cytokines and chemokines that draw immune cells to the infection site. After that, the virus spreads to other organs like the lungs, liver, and spleen, where it keeps reproducing (Tulman *et al*., 2002; Mulatu and Feyisa, 2018). In cattle, the disease is characterized by the development of nodules or lumps on the skin. These nodules develop as a result of the accumulation of inflammatory cells, including lymphocytes and macrophages, as well as the growth of infected cells. The nodules can be uncomfortable and cause secondary infections, which can make the condition worse (Abutarbush *et al*., 2015).

LSD is widespread throughout Africa, the Middle East, and Asia, and it has recently entered Europe. The illness can be spread through contact with infected animals or contaminated objects in addition to being spread by biting insects like ticks and mosquitoes. The disease was discovered in Ethiopia for the first time in 1981, and since then it has spread throughout the country. Ethiopia's lowland regions, where the climate is ideal for insect reproduction and virus transmission, are where the disease is most common. Accoding to Molla *et al*. (2017), a total of 3811 LSD outbreaks were reported in Ethiopia between 2000 and 2015. The disease's animal level morbidity (21.2%) and mortality (4.5%) were recorded in the country.

The clinical signs of LSD in cattle include fever, loss of appetite, and the formation of nodules or lumps on the skin. These nodules can be painful and can lead to secondary infections. In severe cases, the disease can cause death (Coetzer and Tuppurainen, 2004; Abutarbush *et al*., 2015).

Diagnosis of LSD is based on clinical signs and laboratory testing. The virus can be isolated from blood, skin nodules, or other tissues using cell culture or polymerase chain reaction (PCR) techniques. Serological tests can also be used to detect antibodies to the virus (Awad *et al*., 2010).

There is no specific treatment for LSD, and supportive care is the mainstay of treatment. This includes providing pain relief, antibiotics to treat secondary infections, and fluids to prevent dehydration. In some cases, surgical removal of large nodules may be necessary (Constable *et al*., 2017).

Prevention of LSD in cattle involves a combination of vaccination and vector control. Several vaccines are available, and vaccination is recommended in areas where the disease is endemic. Vector control measures, such as the use of insecticides and the removal of standing water, can also help to reduce the spread of the disease (Gupta *et al*., 2020).

Several studies have been undertaken on LSD in Ethiopia. However, most of them were focused on epidemiology of the disease. In addition, to my knowledge, there is only one single case report available on LSD in Ethiopia (Feyisa, 2018). Hence, this case report was conducted for the purpose of describing the diagnostic-therapeutic process of LSD and sharing the clinical experience with other veterinarians.

3.1.4.3. Case description

On January 5, 2021, an exotic breed cow was brought to Addis Ababa University, College of Veterinary Medicine and agriculture, Veterinary Teaching Hospital with a history of nodules on skin, decreased feed and water intake, and decreased milk production for the past four days. The cow was part of a herd of six cattle, consisting of four cows and two calves, one of which was its own 4 months-old calf.

The cow had no recent history of illness, trauma or medication. However, the owner said that the cow was vaccinated once about 5 months ago with a vaccine he didn't remember its type. The cow was reared intensively and fed hay and grass, with usual supplementation of frushka (concentrate feed).

On physical examination, the cow was found to be depressed and febrile, with a rectal temperature of 40.1 °C, had poor body condition, pale mucous membranes, and increased heart rate (74 beats/min) and respiratory rates (34 breaths/min). There were hard nodules on the head, neck, and back skin and swelling of both prescapular and prefemoral lymph nodes. Based on the history and clinical findings, the case was tentatively diagnosed as LSD. EDDIE app also diagnosed the case as LSD on the first rank.

a) Swollen prefemoral lymphnode

b) Nodules on skin

Figure 8 Clinical signs of LSD in cow

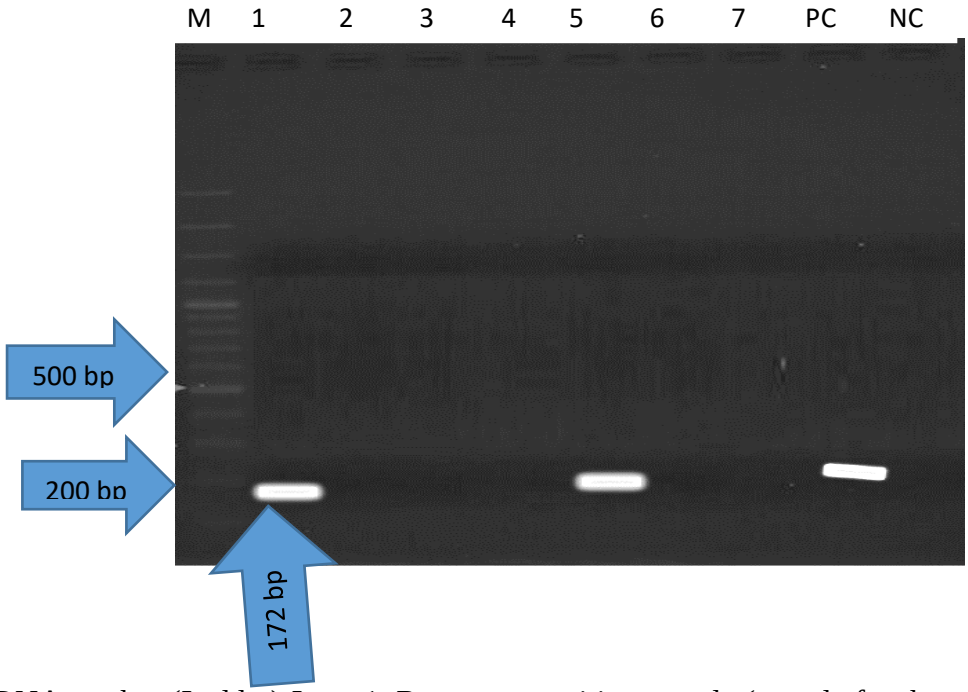
3.1.4.4. Laboratory investigation and findings

For a definitive diagnosis of the case, biopsies of two samples of nodules on the hind quarter were collected. To collect the biopsies, the cow was restrained well and skin around the nodules was anaesthetized using 2ml of 1% Lidocaine. Then, by holding with sterile forceps, nodules biopsies were taken by scissor and placed in a universal tube with 3 ml of sterile phosphate buffer saline with antibiotics. The samples were kept in deep freeze (-20^0C) refrigerator in the microbiology laboratory of AAU-CVMA until processed. To process the sample for DNA detection by PCR, the sample was transported to NVI in a cold chain (icebox with ice pack).

The sample was thawed at room temperature and processed as indicated in the Lumpy Skin Disease manual of the World Organization for Animal Health (OIE, 2017). About 1 gram of sample was cut into small pieces using sterile scissors and ground by mortar and pestle under a sterile class II biosafety cabinet. 10% w/v sample suspensions were prepared by adding 9ml of PBS containing antibiotics and antifungal.

The suspension was transferred to a 10 ml glass test tube and the supernatant fluids were obtained through clarification by centrifugation at 1000xg for about 10 minutes at +4°C. One ml of supernatant fluid was harvested and poured into a sterile cryovial tube for use in the PCR test (OIE, 2017).

For PCR detection, DNA was extracted using a DNeasy kit (Qiagen, USA), according to the manufacturer's instructions. Polymerase chain reaction (PCR) assay was used to detect the virus with capripoxvirus-specific primers: forward primer (5′-TCTATGTCTTGATATGTGGTG GTAG-3′), reverse primer (5′-AGTGATTAGGTGGTGTATTATTTTCC-3′). DNA was amplified in a final volume of 50 µl containing the following: 5 µl PCR buffer (10 mM), 1.5 µl MgCl2 (25 mM), 1 µl dNTP mixture (10 mM), 1 µl forward primer (50 mM), 1 µl reverse primer (50 mM), 5 µl DNA template, 0.5 µl Taq DNA polymerase (5 U/µl) (Invitrogen) and 35 µl of RNAse-free water. The PCR was run in a thermocycler (Applied Biosystems® 2720, USA) using the following amplification programme: initial denaturation at 95°C for 1 min, followed by 40 cycles at 95°C for 30 s, 55°C for 30 s and 72°C for 1 min. Additional elongation was at 72°C for 5 min. Amplified products were analysed using 1.5% gel electrophoresis and positive results were confirmed based on the size (172 base pairs [bp]) of the bands. Accordingly, the result of the PCR test showed positive to LSD with a band around 172 bp.



M: DNA marker (Ladder) Lane 1, Represent positive sample (sample for the current LSD case); where Lane 2-4, 6 and 7, Negative samples from NVI, Lane: 5 Represent positive sample from NVI (vaccine), Lane PC: positive control, lane NC: Negative control.

Figure 9 PCR Result of the Lumpy Skin Disease in exotic breed cow

3.1.4.5. Case management and treatment outcome

The cow was treated with 10% Oxytetracycline (Shanghai Thongren Pharmaceutical Co., Ltd, China) at 10mg/kg/day q.d for three consecutive days to prevent secondary bacterial infections and multivitamin, 20 ml IM stat. The owner was advised to provide supportive care like keeping the animal under shade away from flies, isolating from other healthy animals, and providing adequate water and soft feed and concentrate. Within four days after treatment, the animal became active and had normal appetite. However, the nodules regressed with scar one month after the treatment.

3.1.4.6. Discussion

Lumpy skin disease is a viral disease of cattle caused by capripoxvirus. The disease is prevalent in cattle in Ethiopia and its diagnosis is often tentative based on history and pathognomic clinical sign of nodules on skin (Feyisa, 2018).

This case report describes a physical, clinical, and laboratory diagnosis and treatment of lumpy skin disease (LSD) in an exotic breed cow presented to the Addis Ababa University, College of Veterinary Medicine and Agriculture, Professor Fiseha G/ab Veterinary Teaching Hospital, Bishoftu, Ethiopia.

The physical and clinical examination of the case revealed that depression, fever, poor body condition, pale mucous membranes, increased heart and respiratory rates, nodules on the head, neck, and back skin, and swelling of both prescapular and prefemoral lymph nodes were the clinical signs observed. This is in line with reports and studies on LSD by Feyisa, (2018), Sarkar. (2020), Sudhakar. (2020). EDDIE app also diagnosed the case as LSD. This indicate the accuracy of the app in diagnosing LSD.

Laboratory diagnosis of LSD in this case was based on the collection of biopsies from two nodules on the cow's hindquarter, followed by processing of the samples for DNA detection by PCR. The result of the PCR test showed positive to the disease. This diagnostic approach and result is consistent with other studies, which have also utilized PCR and found positive result for the for LSD virus (Ayelet *et al*., 2013; Feyisa, 2018; Islam *et al*., 2021). In this report, EDDIE app diagnosis and definitive diagnosis are matched, indicating EDDIE app’s accuracy on diagnosing LSD in cattle.

Management and treatment of the case involved supportive care, including administration of antibiotics for preventing secondary bacterial infection and multivitamin. The cow was also isolated from the rest of the herd to prevent the spread of the disease. Eventually, complete recovery was achieved, and the cow was returned to its herd. This is in parallel with (Constable *et al*., 2017; Feyisa, 2018; Islam *et al*., 2021).

In summary, this case report highlights the importance of considering LSD in the differential diagnosis of cattle presenting with nodules on the skin and other related clinical signs. Furthermore, PCR-based diagnostic methods can aid in the definitive diagnosis of the disease, and early management and treatment can lead to successful outcomes.

In conclusion, Lumpy skin disease is a viral infection in cattle that can lead to a variety of clinical signs, including fever, anorexia, and the presence of firm, raised nodules on the skin. Early diagnosis and prompt treatment with supportive care are essential for a successful outcome. Cattle farmers should prevent the disease by measures, such as good hygiene practices, vaccination, and isolation and care of diseased ones.

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3.1.5. Photosensitization in heifer

3.1.5.1. Abstract

Photosensitization is a condition that affects cattle when the skin becomes hypersensitive to sunlight, leading to damage to the skin and underlying tissues. This case report describes an 8-month-old exotic breed calf presented to the Addis Ababa University, College of Veterinary Medicine and Agriculture, Veterinary Teaching Hospital on December 24, 2020, with a history of skin rash, hair loss, scratching, and rubbing white skin area on the body, decreased weight gain, and decreased feed intake for the past three weeks. The calf's condition was tentatively diagnosed as photosensitization based on the history and clinical findings of skin rash, hair loss, scratching, dermatitic, erythemic and sloughed areas of unpigmented or white pigmented skin on the head, neck, limbs, and abdomen. There was no specific test available to determine the disease. EDDIE app diagnosed the case unspecifically (the disease was not registered on the app). The calf was treated with antibiotics to prevent secondary bacterial infection and septicemia, dexamethasone for dermatitis management, and multivitamins for supportive therapy. The owner was advised to change the feed to commercial feed as much as possible for a week, avoid direct sunlight, and follow up within a week. Unfortunately, despite advice given for a follow-up appointment, the owner failed to bring the calf back to the hospital for follow-up. The contact information provided by the owner was also not functional, resulting in the treatment outcome for the case being unknown. Generally, improving the EDDIE to diagnose photosensitization and improving laboratory settings to diagnose the case was forwarded.

Key words: *Photosensitization, Clinical signs, Diagnosis, Treatment*

3.1.5.2. Introduction

Photosensitization is a condition in cattle that occurs when the skin becomes hypersensitive to sunlight, causing inflammation and damage to the skin and underlying tissues. The condition is caused by the accumulation of photosensitizing substances (PS) in the skin, leading to local irritation of unprotected, unpigmented skin after sun exposure(Parkinson, 2010). Four types of photosensitization are differentiated based on the underlying etiology. Type I, or primary, caused by intake of primary PS.

Type II, as a result of inherited defects of porphyrin metabolism. Type III, or hepatogenous, as a result of liver damage and ensuing faulty excretion of phylloerythrin. Type IV, or idiopathic, as a result of undetermined etiology (Constable *et al*., 2017).

Clinical signs of photosensitization in cattle may vary depending on the severity of the disease but generally include redness, swelling and crusting of the skin, particularly on the face, ears and udder. In severe cases, the skin may ulcerate and slough, leading to secondary bacterial infections. Affected animals may also show signs of pain, such as a reluctance to move or eat. Primary cases, Type I have cutaneous signs only (erythema, edema, necrosis, gangrene of light-colored skin or mucosae exposed to sunlight). Secondary cases, Type II and III, have signs of hepatic dysfunction (jaundice, prostration, short course, death) or porphyrin metabolism (Roberson *et al.*, 2012).

Diagnosis of photosensitization in cattle is usually based on clinical signs and history of exposure to potential causative agents. In most cases a tentative diagnosis can be made based on clinical presentation, history of the animal (recently pastured, access to certain plants, etc.). There are no specific diagnostic tests to confirm photosensitization. However, Hepatogenous photosensitization can be diagnosed by analysis of plasma phylloerythrin concentration using a spectroscopic method. Plasma or serum fluorescence can be used to measure the increase in phyloerythrin above normal prior to liver photosensitization. Blood tests and liver biopsies can also be used to diagnose liver disease as a possible cause of the disease (Giaretta *et al*., 2014).

Treatment of photosensitization in cattle involves removing the animal from the source of the causative agent and providing supportive care, such as fluid therapy and pain management. Topical treatments, such as corticosteroid creams, can also be used to reduce inflammation and promote healing of the skin. Prevention measures include avoiding exposure to potential causative agents, such as toxic plants or chemicals, and monitoring the health of the animals for signs of liver disease (Schild *et al*., 2004).

Tough the condition is common in animals and occur worldwide, there are very few reports available in Ethiopia (Wondimu *et al*., 2021). Hence, this case report was to just report the occurrence of the disease, and its diagnosis on a calf presented at professor Fiseha G/ab veterinary teaching Hospital, Bishoftu, Ethiopia.

3.1.5.3 Case description

An 8 month-old exotic breed calf was brought to AAU-CVMA, Professor Fiseha G/ab VTH with a history of skin rash, hair loss, scratching, and rubbing white skin area on the body, decreased weight gain, and decreased feed intake for the past three weeks. The calf was part of a herd of four cattle, consisting of its mother, one bull and one cow. The calf had no history of illness, vaccination, house change, feed change, trauma or medication. It was reared semi-intensively and fed hay and grass in addition to nursing. The owner said that other cattle in the herd were not affected.

On physical examination, the calf was found to be depressed, alopecic, ulcerated, dermatitic, erythemic, warmed and sloughed white skin area on the head, neck, limbs, and abdomen. In addition, the calf had poor body condition and pale mucous membranes, however, other vital signs including temperature, heart rate, and respiratory rates were in the normal range. Based on the history and clinical findings, the case was tentatively diagnosed as photosensitization. In addition, EDDIE app diagnosed the case as zz-other (meaning that the disease was not specifically mentioned in the app).

Figure 10 Calf with clinical signs of photosensitization (depressed and alopecic)

3.1.5.4. Laboratory investigation and findings

Since there was no serum biochemistry test available to diagnose the case by plasma phylloerryhtin level, laboratory tests like fecal parasitological tests (simple floatation and sedimentation test), and blood giemsa stain were conducted to identify the underlying cause of the disease. Both tests showed negative results for parasitic infection (liver fluke and blood protozoal infection). PCV test was also conducted on blood to know whether the animal is anaemic or not.

3.1.5.5. Case management and treatment outcome

The calf was treated with 20% oxytetracycline, 20mg/kg (20 ml/100kg), IM, stat to prevent secondary bacterial infection and septicaemia. Dexamethasone (Sokar Healthcare Pvt.Ltd. Gujarat India) 0.2mg/kg/dayIM, per day for three consecutive days were administered to manage dermatitis. In addition, multivitamin (centre-vitamins, Aether Centre (Beijing) Biology Co., Ltd.'s, China) at a dose of 20 ml per animal, IM, stat, were administered as supportive therapy. The owner was also advised to avoid the animal from direct sunlight and change the feed to commercial feed as much as possible for about a week. To follow up on the treatment outcome of the animal, the owner was told to bring back the calf after a week. However, he didn't bring the calf and also his phone number was not functional.

3.1.5.6. Dicussion

Photosensitization is a condition in cattle that occurs when the skin becomes hypersensitive to sunlight, resulting in inflammation and damage to the skin and underlying tissues. The disease is caused by the accumulation of photosensitizing substances in the skin, leading to irritation of unprotected, unpigmented skin after exposure to sunlight. There are four types of photosensitization, including primary, inherited, hepatogenous, and idiopathic, each with a different underlying cause (Parkinson, 2010; Constable *et al*., 2017).

In this case report, the clinical signs, diagnosis, and treatment of photosensitization (tentatively diagnosed) in eight month old calf was presented. The presented calf had clinical signs of depression, alopecia, ulceration, dermatitis, and redness on the head, neck, limbs, and abdomen. This is in agreement with the case reports by (Schild *et al*., 2004; Lazaro *et al*., 2018).

Diagnosis of photosensitization can be based on clinical signs and history of exposure to potentially causative agents and may involve blood tests including plasma phylloerythin, fecal examination, and liver biopsies to diagnose liver disease (Giaretta *et al*., 2014; Souza *et al*., 2012). EDDIE app diagnosed the case as zz-other (meaning that the disease was not specifically mentioned in the app). This showed a need for improvement the app to diagnose the case.

In this case, history, clinical signs, blood test by Giemsa stain and PCV test, and fecal floatation and sedimentation tests were conducted to diagnose the disease, which is consistent with the reports on cattle photosensitization (Schild *et al*., 2004; Giaretta *et al*., 2014; Lazaro *et al*., 2018). However, plasma phylloerryhtin test and liver biopsies were not conducted due to limited diagnostic settings.

Both blood tests and fecal examination performed showed negative results indicating the absence of parasitic diseases affecting the animal's liver. This is consistent with (Jesse and Ramanon, 2012; Lazaro *et al*., 2018). In addttion, during the physical examination of the animal, there were no any sign of liver disease observed in the animal. This might rule out hepatogenous cause of photosensitization. Hence, this case might be primary, inherited or idiopathic. Feed (hay and grasses consumed by animal) analysis was also not performed in this study due to a limitied diagnostic setting, which might give a clue to diagnose primary phtotosensitization. According to the owner, there was no such case previously happened on his farm, which can support to rule out inherited photosensitization, but it needs deep analysis of the phylogeny of the animal to rule out it.

Treatment of photosensitization in cattle involves removing the animal from the source of the causative agent and providing supportive care, such as fluid therapy and pain management, which is in agreement with literatures (Constable *et al*., 2017).

In conclusion, Photosensitization is a condition in cattle that can be caused by a variety of factors, including ingestion of certain plants, liver disease, and exposure to certain drugs or chemicals. Prevention measures, such as avoiding exposure to potential causative agents and monitoring the health of the herd, can help reduce the risk of photosensitization. In this case, the root cause of photosensitization and its treatment outcome were not identified. Hence, further study with appropriate diagnostic methods are needed to diagnose the underlying cause of photosensitization and its treatment outcome.

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3.1.6. Fascioliasis in an Ox

3.1.6.1. Abstract

Fascioliasis is a parasitic disease caused by liver flukes of the genus Fasciola and commonly affects domestic livestock, such as cattle, sheep, and goats. This case report describes a 6-year-old ox presented to Modjo veterinary clinic on October 1, 2021, with diarrhea, decreased feed and water intake, decreased plowing ability, and decreased weight gain. Based on history and clinical findings, Fasciolosis was the tentative diagnosis. A fecal sample was processed and examined by sedimentation technique. The sedimentation result revealed an ellipsoidal operculated egg of Fasciola, confirming the diagnosis. EDDIE app diagnosed the case as Trypanosomiasis, indicating the mismatch with confirmatory diagnosis. Triclabendazole bolus was administered, and the ox showed gradual improvement and recovered from the disease within a week. The ability of liver flukes to adapt to new environments and hosts, including intermediate and definitive hosts, plays a critical role in the spread of Fasciolosis. Appropriate diagnosis and appropriate treatment are critical to effectively manage Fasciolosis.

Key words: *Fascioliasis, clinical findings, Diagnosis, Ox, Triclabendazole*

*3.*1.6.2. Introduction

Fasciolosis is a parasitic disease that affects domestic livestock, particularly cattle, sheep, and goats, and is caused by digenean trematodes of the genus Fasciola, known as liver flukes. Two species of liver flukes commonly involved in fasciolosis are F. hepatica (temperate liver fluke) and F. gigantica (tropical liver fluke). The ability of liver flukes to adapt to new environments, intermediate hosts, and definitive hosts plays a significant role in the spread of the disease (Bekele and Getachew, 2010).

The pathogenesis of fasciolosis in cattle involves several stages. The adult flukes of Fasciola hepatica live in the bile ducts of the liver and feed on blood. The eggs produced by the adult flukes are passed out in feces and can contaminate pastures where they hatch, releasing miracidia. The miracidia infect freshwater snails, where they produce sporocysts that go through multiple developmental stages to produce cercariae, which are released from the snail. The cercariae encyst on vegetation and form metacercariae, which are infective to the cattle (Calvani *et al*., 2018).

The metacercariae are ingested by the cattle while grazing, and once ingested, excyst in the small intestine, release juvenile worms, and penetrate the intestinal wall to enter the abdominal cavity. They then migrate through the liver parenchyma to the bile ducts. This migration induces tissue damage, inflammation, and fibrosis in the liver. The liver flukes mature, reproduce, and feed in the bile ducts of the liver, causing obstruction, inflammation, and fibrosis of the bile ducts, and leading to cholestasis and anemia in the cattle (Elelu and Eisler, 2018).

During this process, the infected cattle suffer significant morbidity and mortality due to damage to the liver and the resulting pathophysiological effects on the body. The severity of the disease depends on various factors such as the number of infective metacercariae ingested, the age and immunity status of the animal, the species and virulence of the parasite involved, and the presence of other diseases (Avcioglu *et al*., 2014).

Fasciolosis in cattle is characterized by weight loss, anemia, and hypo proteinemia. In Ethiopia, the prevalence of the disease is as high as 83.08% in cattle. The prevalence of fasciolosis is influenced by the climate, ecological conditions, and livestock management practices, along with the survival and distribution of the parasites and their intermediate host, snails (Abunna *et al*., 2010).

Clinical signs of fasciolosis in cattle depend on the severity and duration of the infection. In early stages, it may not show any clear symptoms. As the disease progresses, however, the following clinical signs, such as weight loss, anemia, rough hair coat, edema, diarrhea, decreased appetite, and Jaundice (Elelu and Eisler, 2018).

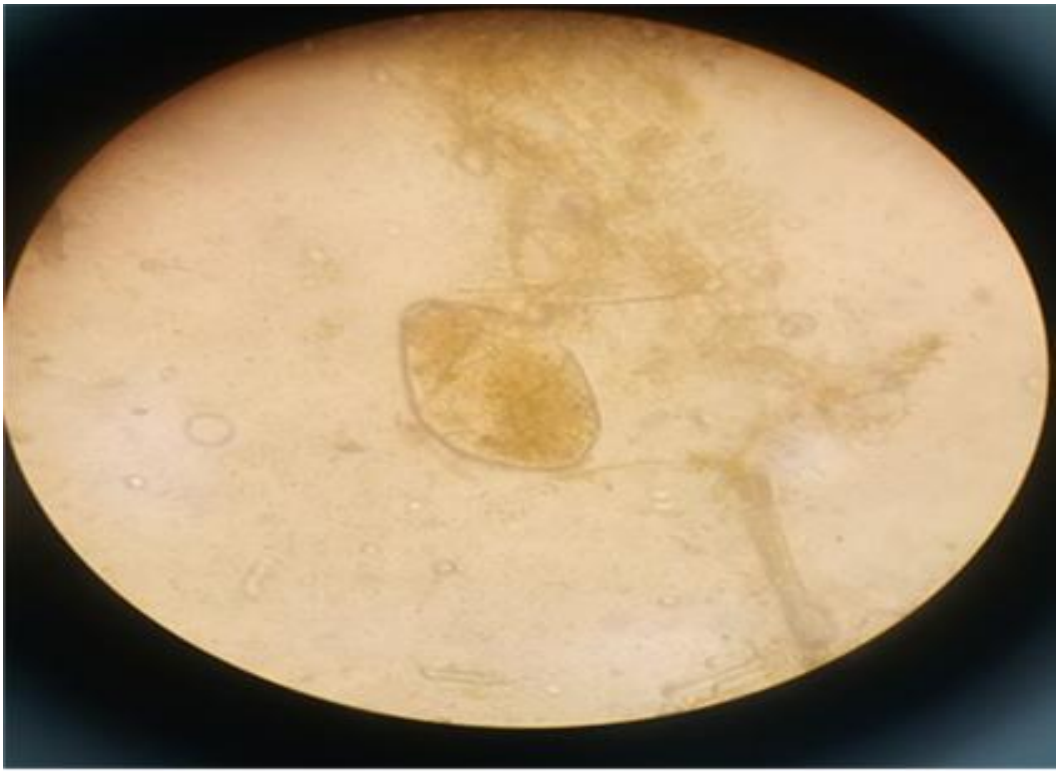
Diagnosis of fasciolosis is based on clinical signs, grazing history, seasonal occurrence, laboratory tests of fecal samples, and post-mortem examination. The sedimentation test is one of the commonly employed diagnostic tools for the detection of Fasciola eggs in fecal samples. It is preferred over simple flotation methods for detecting trematode eggs, like Fasciola, as the eggs are heavier and denser and settle quickly (Charlier *et al*., 2014).

Fasciolosis can be prevented by reducing the intermediate host population and using anthelmintic (Tsegaye *et al*., 2012).

Generally, Fasciolosis is a prevalent parasitic infection in cattle in Ethiopia, causing significant economic losses. The disease commonly ientified in the highland areas of Ethiopia,and there is few report on the occurrence of the disease in Central Ethiopia, Hence this case study was conducted to describe the clinical signs, diagnosis, and treatment of Fasciloisis in an ox presented to AAU-CVMA, Professor Fiseha G/ab VTH.

3.1.6.3. Case Description

A 6-year-old brown colored local breed ox weighing about 180kg was presented to AAU-CVMA-VTH from Babogaya area, Bishoftu town, on October 1, 2021, with a history of diarrhea, decreased feed and water intake, decreased ploughing ability, and decreased weight gain for the past two weeks. The ox was reared extensively with other three cattle and grazes grasses around Babogaya Lake. On physical examination, the ox had mild dehydration, a pale mucous membrane, mild diarrhea, poor body condition, and little sub mandibular edema. However, the ox's temperature (37.1 °C), heart rate (60), respiratory rate (20), pulse rate (62), and gait was found normal. Based on the history and clinical findings, possible differential diagnoses of the case, such as, Fasciolosis, Coccidiosis, and Strongylosis were listed. Then, considering the epidemiology (the ox graze around Babogaya Lake), history and clinical findings, the case was tentatively diagnosed as Fasciolosis. In addition, EDDIE app diagnosed the case as GIT parasites.



a) b)

Figure 11 Presented ox (a) and Fasciola egg observed under microscope, (b) (400X)

3.1.6.4. Laboratory Investigations and findings

To confirm the case, a fecal sample was collected from the rectum of the ox and processed at veterinary parasitology laboratory of CVMA. Both the simple floatation technique and sedimentation technique were conducted. The result of the sedimentation test revealed an ellipsoidal operculated egg of Fasciola, (Figure 11b), but there was no egg observed by floatation technique. Finally, based on the history, clinical signs, EDDIE app, and laboratory findings, the case was definitely diagnosed as Fasciolosis.

3.1.6.5. Case management and treatment outcome

Based on the definitive diagnosis, an ox was treated by Triclabendazole bolus (12 mg/kg, per os, stat). In addition, multivitamin (1ml/10kg, IM, Stat) was administered as a supportive therapy. The owner reported that the ox's signs improved gradually and had recovered from the disease with in a week.

3.1.6.6. Discussion

Fasciolosis is a common parasitic disease of cattle in Ethiopia. The disease can cause significant morbidity and mortality, and is characterized by progressive weight loss, decreased feed intake, diarrhea, anemia, and liver damage. Fasciolosis has been identified in different parts of Ethiopia.

This report describes a case of fasciolosis in a 6-year-old brown colored local breed ox from the Babogaya area, Bishoftu town. The ox showed clinical signs of fasciolosis such as diarrhea, decreased feed intake, decreased weight gain, and mild submandibular edema. This is in agreement with reports on Fascilosis in cattle (Bekele and Getachew, 2010; Tsgeaye *et al*., 2012; Aregay *et al*., 2013). EDDIE app diagnosed the case as Trypanosomiasis, indicating the mismatch with confirmatory diagnosis.

The diagnosis was confirmed based on the results of the sedimentation test, which revealed Fasciola operculated eggs in the fecal sample. This is in line with reports by Abuna et al. (2010), Avcioglu *et al*. (2014). Sedimentation is best coprological test to diagnose Fasciliasis than floatation. This is because fluke eggs are heavy compared with the eggs of gastrointestinal parasites like nematodes (Charlier *et al*., 2019; Calvani *et al*., 2018; Elelu and Eisler, 2018).

According to Aregay *et al*. (2013), and Avcioglu *et al*. (2014), Fascioliasis commonly occur in swampy area. In this case, the extensive rearing system of the ox and the grazing area around Babogaya Lake highlights the relevance of environmental factors in the epidemiology of the disease.

In this case, the EDDIE app diagnosed tentative diagnosis of the case as gastrointestinal parasites. This shows the correctness of the daignosis, since Fascilosis is categorized under GIT paasites, but it should be more specific to typically diagnose fasioliasis.

Triclabendazole is a commonly used anthelmintic for the treatment of fasciolosis, and was used as a single dose in this case. The supportive therapy with multivitamin was administered to improve the animal's overall health. The owner reported a gradual improvement in the ox's clinical signs after treatment and recovery from the disease within a week. This treatment protocol and outcome is in agreement with other reports (Khan *et al*., 2009: Constable *et al*., 2017).

In conclusion, fasciolosis is a common parasitic disease of cattle that commonly occur in swampy area. The use of appropriate diagnostic techniques, targeted anthelmintic treatment, and supportive care are important measures that can help in the recovery of affected animals. Early diagnosis, prevention, and management are essential to control the disease.

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3.2. Case Reports on Canine

3.2.1. Babesiosis in Mastiff Breed Dog

3.2.1.1. Abstract

Babesiosis is a tick-borne disease that affect dogs and is caused by a protozoan parasite of the genus Babesia. The parasite infects and destroys red blood cells, leading to anemia, fever, lethargy, red urine, and other symptoms. This case report describes a 5-year-old male Mastiff breed dog presented to the Addis Ababa University, College of Veterinary Medicine and Agriculture, Veterinary Teaching Hospital on December 9, 2020, with a history of previous babesiosis infection, dark-colored urine, lethargy, anorexia, and excessive salivation. Diagnoses of the case involved history, physical and clinical diagnosis, and laboratory examination. The physical and clinical examination revealed signs of depression, pale mucous membranes, fever,

increased heart and respiratory rate. Laboratory tests using giemsa stain of blood smear, confirmed the diagnosis of Babesiosis based on the detection of intracellular Babesia parasites in the dog's blood smear. Complete blood count of the dog revealed marked leucocytosis and thrombocytopenia. Various differential diagnoses such as Urinary Tract Infection, Leptospirosis, Ehrlichiosis, and Anaplasmosis were also considered. The dog was treated using diminazene aceturate, vitamin B complex, and fluid therapy. Antiemetics was also administered to prevent vomiting. The dog recovered and attained its normal health status after a week. This case highlights the need to recognize the clinical signs of babesiosis in dogs, perform appropriate diagnostic tests, and provide prompt and effective treatment to minimize morbidity and mortality of affected dogs.

Key words: *Babesiosis, Mastiff dog, Diagnoses, Giemsa stain, Complete Blood Count, Treatment, Ethiopia*

3.2.1.2. Introduction

The protozoan parasite Babesia is the cause of the tick-borne disease babesiosis. Particularly in regions where ticks are common, it is a serious health concern for dogs (Solano *et al*., 2016).

Babesia canis, Babesia gibsoni, Babesia vogeli, and Babesia rossi are the common Babesia species that infect dogs. Geographical location and environmental factors affect how common these species are. The prevalence of these species varies depending on geographic location and environmental factors.

The disease has been diagnosed in dogs from different parts of Ethiopia with a prevalence rate of 10-30 % (Ghirotti *et al*., 1990; Tsegay *et al*., 2016; Hordofa and Adugna, 2017; Tadesse *et al*., 2023).

Babesia has a two-host life cycle. After a tick becomes infected by feeding on an infected mammal such as a dog, the Babesia parasite undergoes sexual reproduction, producing sporozoites that embed themselves in tick salivary glands. During a new feeding, these are transferred into the dog's bloodstream, where they penetrate red blood cells to undergo asexual reproduction to produce more merozoites. The cycle continues with each new invasion and replication, which ultimately leads to anemia and other clinical signs of babesiosis in dogs. Babesia can also be transmitted from an infected mother dog to her puppies during pregnancy or

nursing. The cycle completes after infected ticks feed on new animals, allowing the parasite to continue its life cycle (Irwin, 2010; Petra *et al*., 2018).

The clinical signs of babesiosis in dogs can vary depending on the severity of the infection and the species of Babesia involved. The most common clinical signs of babesiosis in dogs include anemia, fever, and hemoglobinuria, and lethargy, loss of appetite, enlarged lymph nodes, pale mucous membranes, and jaundice. In severe cases, Babesia infection can cause neurological signs, such as seizures, ataxia, and behavioral changes. It is important to note that not all dogs infected with Babesia will show clinical signs, and some dogs may only have mild or transient signs (Schoeman, 2009; Vishwakarma and Nandini, 2019).

The diagnosis of babesia in dogs involves a combination of clinical signs, laboratory tests, and history of tick exposure. The most common diagnostic methods used to diagnose babesia in dogs include blood smear examination, polymerase chain reaction (PCR), serology, complete blood count (CBC), and history and clinical signs.

Blood smear examination involves examining a blood sample under a microscope to look for the presence of Babesia parasites in the red blood cells (Solano *et al*., 2016). PCR is a molecular diagnostic test that detects the DNA of Babesia parasites in the blood. Serology involves testing the dog's blood for the presence of antibodies against Babesia parasites. A CBC can reveal anemia, thrombocytopenia, and other changes in the blood that are consistent with babesiosis. A history of tick exposure and clinical signs consistent with babesiosis can also support the diagnosis of babesia in dogs. It is important to note that a combination of these diagnostic methods may be necessary to confirm the diagnosis of babesia in dogs (Petra *et al*., 2018).

The treatment of babesia in dogs involves a combination of medications and supportive care. The goal of treatment is to eliminate the Babesia parasites from the dog's bloodstream and manage the clinical signs associated with the infection (Yadav *et al*., 2011). The most common medications used to treat babesia in dogs include imidocarb dipropionate, atovaquone, and azithromycin. These medications are effective in killing the Babesia parasites and reducing the severity of clinical signs (Fabisiak *et al.*, 2010).

In severe cases, blood transfusions may be necessary to manage anemia and other complications. Supportive care, such as fluid therapy, pain management, and nutritional support, is also

important to help the dog recover from the infection. It is important to monitor the dog's response to treatment and adjust the treatment plan as needed (Petra *et al*., 2018). The prognosis for infected dogs is generally quite good, with approximately 85–90% of cases surviving the illness, depending on the level of care and the Babesia species involved (Schoeman, 2009).

Dogs with babesia should be closely monitored for several weeks after treatment to ensure that the infection has been fully eliminated. Additionally, tick prevention measures should be implemented to prevent future infections. Early diagnosis and treatment are important for a successful outcome in dogs with babesia (Petra *et al*., 2018).

There is very few reports on case studies of babesiosis in dog in Ethiopia. Hence, this case report was undertaken to describe the occurrence, clinical signs, diagnosis, and treatment outcome of babesiosis in a mastiff breed dog presnted to AAU-CVMA, Professor Fiseha G/ab VTH, Bishoftu.

3.2.1.3. Case description

Ambes, a 5-year-old male Mastiff breed dog with brown coat color, was brought to the AAU-CVMA, VTH, on December 9, 2020, from Laga Tafo laga Dadi town with a history of dark-colored urine, lethargy, anorexia, and excessive salivation for the past two days (**Figure).** Ambes was imported from South Africa a year ago and had a previous history of babesiosis infection.

According to the owner, Ambes received a rabies vaccination three months ago. Ambes is given two meals a day consisting of meat and bones purchased from a butcher shop and resides in a small kennel. The majority of its time is spent indoors, both in its kennel and within the compound, and has no contact with other animals.

Upon the physical examination, Ambes had lethargy, dehydrated, pale mucus membranes, and hyper-salivation. Additionally, Ambes had an increased rectal temperature of 39 ℃, and slightly increased heart rate of 75 beats per minute, and a respiratory rate of 35 breaths per minute. However, all other areas and systems appeared normal, but its urine and micturition condition were not examined, as the dog did not urinate despite sensitization (massaging) to urinate.

Based on history and clinical signs, the case was tentatively diagnosed as Babesiosis, and potential differential diagnoses including Urinary Tract Infection, Leptospirosis, Ehrlichiosis, and Anaplasmosis were listed. On other hand, although rabies was not suspected in this case,

strict precaution was taken during examination, and also the owner was advised to take precaution while handling the dog due to the hypersalivation condition of the dog.

a) b)

Figure 12 Clinical sign of Babesiosis, lethargy (a), and treatment outcome, after recovery (b)

3.2.1.4. Laboratory examination and findings

To confirm the case, the ear vein was pierced and blood was collected into a capillary tube, and a thin smear was made and dried immediately. In addition, blood was collected from a cephalic vein into EDTA based vacutainer tube for CBC test and transported in a cold chain to the laboratory. Moreover, Feces of the dog was also collected and its examination was carried out by both sedimentation and floatation tests. Then, a complete blood count (CBC) of blood was conducted using mindray CBC machine, and a giemsa stain of blood smear was also performed. The Giemsa stain of the blood smear revealed the presence of Babesia parasites within the red blood cells. The CBC revealed marked leucocytosis (19.8 × 103/µL), and thrombocytopenia (30× 103/µL). Both sedimentation and floatation tests showed negative for GIT parasite infestation. Based on these findings, Ambes was definitely diagnosed with Babesiosis.

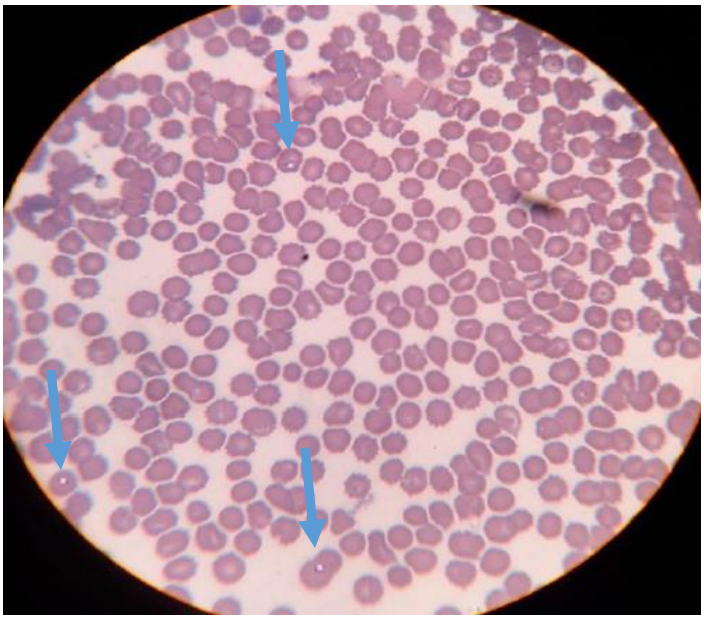

Figure 13 Babesia in blood of a dog

Table 1 Complete blood count of the examined dog

parameters	Result	Remark	Reference
WBC	19.8 × 10^3/µL	High	5.0–14.1× 10^3/µL
Lymphocytes	3.2× 10^3/µL	High	0.4–2.9× 10^3/µL
Mid	4.7× 10^3/µL	Normal	3.5-5× 10^3/µL
Granulocytes	11.9× 10^3/µL	Normal	60-80× 10^3/µL
Lymphocytes %	16.1%	Normal	8–21%
Mid%	23.6%	High	3-20%
Granulocytes%	60.3%	Normal	58–85%
Hemoglobin	13.2g/dl	Normal	11.9–18.9 g/dl
RBC	5.77× 10^6/µL	Normal	4.95–7.87× 10^6/µL
Hematocrit(HCT)	39%	Normal	35–57%
MCV	67.6 fl	Normal	66–77 fl
MCH	22.8 pg	Normal	21–26.2 pg
MCHC	33.8g/dl	Normal	32–36.3 g/dl
Platelet	30× 10^3/µL	Low	211–621× 10^3/µL
MPV	11.0 fl	High	6.1–10.1 fl

3.2.1.5. Case management and treatment outcome

Ambes was treated with diminazene aceturate (Diminol, Korea) at a dose of 5ml/100kg IM stat and supportive care by intravenous (IV) administration of Ringer lactate fluid (Addis Pharmaceutical factory PLC, Ethiopia) and vitamin B complex. In addition, to stop vomition, Antiemetics (Metaclopromide @ 0.5 – 1.0 mg/kg body weight, IV) was given once on the day of

presentation. Moreover, penstrep (norbrook) was given to prevent secondary bacterial complication.

Following the treatment, a phone conversation with the owner revealed that the dog's condition gradually improved, vomiting ceased on second day after treatment, severity of clinical signs such as bloody urine color, appetite, and the mood of the animal returned to normal, indicating the recovery of the dog. After a week, Ambes was also visited at his owner’s home and it was fully recovered and attained its normal health status (Figure 12b).

3.2.1.6. Discussion

Babesiosis is a tick-borne disease that affects dogs and is caused by a protozoan parasite of the genus Babesia. The parasite infects and destroys red blood cells, leading to anemia, fever, lethargy, red urine, and other symptoms (Teodorowski *et al*., 2020).

This case report expalined the successful diagnosis and treatment of babesiosis in a 5-year-old male Mastiff breed dog. The diagnostic process involved taking a history, conducting a physical examination, and performing laboratory tests. This diagnostic process is in line with the diagnostic recommendations on babesiosis (Petra *et al*., 2018). However, reports by Yadav *et al*. (2011), have included ultrasonographic examination in clinical examination of the dog affected with babesiosis, which was not used in this case due to a lack of the equipment.

The owner reported that the dog had red-colored urine, anorexia, and lethargy, which were the chief complaints. The physical and clinical examination revealed signs of depression, pale mucous membranes, fever, increased heart and respiratory rate, which are consistent with previous reports by Boozer and Macintire (2003), and Solano *et al*. (2016) indicating similar symptoms observed in dogs with babesiosis. However reports by Conrad *et al*. (1991), Fabisiak *et al*. (2010), and Yadav *et al*. (2011) found jaundice (icterus) in dogs affected by babesiosis. This might be due to difference in severity or duration of the disease in affected animals. Since the present case was detected early, jaundice (icterus) might not developed.

Differential diagnosis listed during the diagnosis of this case include urinary tract infection, Leptospirosis, Ehrlichiosis, and Anaplasmosis. This is in parallel with Teodorowski *et al*. (2020), and Birkenheuer, (2021).

Laboratory investigation of the case involved a complete blood count (CBC), giemsa stain of blood smear, and fecal examination. This is in line with Yadav *et al*. (2011), and Solano *et al*. (2016). However, those reports have included urinalysis, blood chemistry analysis, and PCR method, which were not used in this case due to limited laboratory settings.

The laboratory analysis, including CBC count, fecal examination, and Giemsa stain of blood smear, showed mild leukocytosis and thrombocytopenia. The Giemsa stain confirmed the presence of Babesia parasites in the red blood cells, thereby confirming the diagnosis. These findings are consistent with previous reports by Boozer and Macintire (2003), Yadav *et al*. (2011), Teodorowski *et al*. (2020), and Birkenheuer, (2021). However, anemia was not observed in this case, though it was a common laboratory finding reported in previous studies. This discrepancy could be due to differences in the severity and duration of the disease among the animals.

The supportive care via intravenous administration of ringer lactate fluid, metoclopromide, and vitamin B complex combined with Diminazene aceturate helped in the elimination of Babesia parasites and in alleviating the clinical signs of the disease. This treatment approach is consistent with various case reports (Ayoob *et al*., 2010; Yadav *et al*., 2011; Berzina *et al*., 2013).

In conclusion, babesiosis is a serious tick-borne disease that affects dogs and can lead to severe clinical signs. Early detection and treatment of babesia infection are essential for preventing severe clinical signs and complications in dogs. Hence, pet owners should take preventive measures to protect their dogs from tick infestations and seek veterinary care if they notice any clinical signs of babesiosis.

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3.2.2. Hepatic Cirrhosis in a Bitch

3.2.2.1. Abstract

Hepatic cirrhosis is a form of liver disease that affects dog, and is characterized by the growth of nodules in the liver tissue. This case report describes a 6-year-old cross-breed bitch presented to AAU-CVMA, Veterinary Teaching Hospital, on February 2, 2021, with a history of lethargy, anorexia, polydipsia, weight loss, relapsing ascites, and vomiting for the past three weeks. Upon physical examination, the dog was noted to have clinical signs of poor body condition, abdominal distension, ascites, a decreased rectal temperature (36 °C) and a slightly increased heart rate (82 beats/min) and respiratory rate (40 per minute). Based on history and clinical signs, the case was tentatively diagnosed as liver dysfunction. Laboratory test of blood by packed cell volume test revealed anaemia, fecal examination by both simple floatation and sedimentation techniques, and Giemsa stain of blood smear results found negative for helminths and protozoal diseases. The abdominal fluid examination revealed ascitic fluid. These all results showed non infectiousness of the case and supported tentative diagnosis (livr dysfunction). Based on the findings, the case was symptomatically treated by supportive therapy, including abdominal paracentesis, administration of ringer lactate fluid, vitamin B complex, and anti-emetic. Despite the treatment, the bitch died after two days. Necropsy examinations of the carcass perfomed and revealed the presence of nodules of varying sizes throughout the liver parenchyma surrounded by fibrous tissue, confirming the diagnosis as hepatic cirrhosis. Generally, this case emphasizes the

importance of recognizing the clinical signs and diagnosis of hepatic cirrhosis. Further investigations into the potential causes of hepatic cirrhosis in dogs could provide critical information about the condition's pathogenesis and create opportunities for early interventions to reduce morbidity and mortality.

Key words: *Hepatic Cirrhosis, Dog, Clinical Signs, Laboratory Investigations, Treatment, Necropsy*

3.2.2.2. Introduction

Hepatic cirrhosis is a form of liver disease that affects dog, and is characterized by the growth of nodules in the liver tissue. It may result in severe liver dysfunction, which can shorten life expectancy and lower quality of life. Numerous conditions, such as chronic hepatitis, toxic liver damage, and copper storage disease, are potential causes of the illness.

Chronic hepatitis can be caused by infectious canine hepatitis, canine adenovirus, and leptospirosis. Drugs, chemicals, or toxins, such as aflatoxins, which are produced by specific types of mold, can all result in toxic liver damage. A genetic disorder called copper storage disease results in copper building up in the liver, causing cirrhosis and other liver damage (Horiguchi *et al*., 2009; Twedt, 2017).

Hepatic stellate cells are activated during the pathogenesis of hepatic cirrhosis, which results in the deposition of extracellular matrix and the growth of fibrous tissue. The formation of nodules and the disruption of liver function result from the fibrous tissue replacing the normal liver tissue. Numerous factors, such as inflammation, oxidative stress, and cytokines, can cause the activation of hepatic stellate cells (Twedt, 2017).

Hepatic cirrhosis in dogs can present with a variety of non-specific clinical symptoms, such as anorexia, vomiting, diarrhea, lethargy, and an enlarged abdomen. Dogs may experience jaundice, ascites, and hepatic encephalopathy as the condition worsens (Makinde *et al*., 2019).

Canine hepatic cirrhosis is not contagious and cannot be passed from one dog to another. However, the disease can be caused by exposure to toxins or infectious agents, which can be transmitted through contaminated food, water, or environment (Wu *et al*., 2014; Eulenberg and Lidbury, 2018).

Clinical symptoms, blood tests, and imaging tests like computed tomography (CT) scans and ultrasounds are used to diagnose hepatic cirrhosis in dogs. Blood tests may reveal elevated liver enzyme levels and decreased albumin levels. Nodular liver tissue, uneven liver margins, and ascites may all be visible on imaging tests. To confirm the diagnosis and identify the disease's underlying cause, a liver biopsy may be required (Vijoyanand and Nagarajan, 2007; Guidobono *et al*., 2012).

The main target of hepatic cirrhosis treatment in dogs is to manage the clinical symptoms and stop further liver damage. The use of medications to treat vomiting, diarrhea, and hepatic encephalopathy as well as dietary management and fluid therapy are all possible forms of treatment. In some circumstances, surgery may be required to remove liver nodules or to perform a liver transplant. Hepatic cirrhosis in dogs has an unfavorable prognosis and can advance quickly, causing liver failure and eventual death (Twedt, 2017; Abalaka *et al*., 2021).

Depending on the underlying causes and risk factors in various areas and populations, hepatic cirrhosis in dogs occurs at varying rates. For instance, a study done in the United States found that among a population of over 100,000 dogs, the prevalence of hepatic cirrhosis was 0.5% (Kwochka *et al.*, 1994). In contrast, a study carried out in Nigeria on 200 dogs revealed a prevalence of 11.5 percent (Makinde *et al*., 2019).

There haven't been any prior reports of canine hepatic cirrhosis in Ethiopia, despite the fact that it is a widespread liver condition in dogs worldwide. Hence, this case report was undertaken to describe the occurrence, clinical signs, diagnosis, treatment and postmortem findings of hepatic cirrhosis in a dog at AAU-CVMA, Professor Fisseha G/ab veterinary teaching hospital.

3.2.2.3. Case description

A 6-year-old female cross-breed dog weighing about 15 kg was presented to AAU-CVMA, VTH on February 2, 2021. The dog was presented with a history of lethargy, anorexia, polydipsia, weight loss, ascites, and vomiting for the past two weeks. The dog had no history of repeated medication, but was brought to the same hospital a month ago with the same condition and treated with antibiotics (penstrep) and paracentesis of the abdominal fluid, but the condition relapsed again. The dog is kept indoors and fed on meat, bones, and sometimes left-over food. The dog had been vaccinated against rabies four months ago.

Upon physical examination, the dog had poor body condition, a lethargic, pale mucus membrane, and abdominal distension with shifting dullness and fluid moving during percussion. The dog had a decreased rectal temperature (36 °C) and a slightly increased heart rate (82 beats/min) and respiratory rate (40 per minute). Other systems appeared normal. Based on history and clinical signs, liver disease was tentatively diagnosed.

3.2.2.4. Laboratory investigation and findings

To confirm the case, samples (blood, faeces, ascitic fluid) were collected. Blood analysis revealed, anaemia (PCV = 30%), The faecal examination by direct smear, simple floatation and sedimentation technique, and blood test by Giemsa stain showed negative results for helminths and protozoal diseases. The ascitic fluid analysis revealed that the fluid was transparent and clear, indicating ascites due to liver dysfunction.

Despite a treatment of the case as mentioned in case management and treatment outcome section of this case report, the dog was died and a necropsy was performed. On necropsy about four litter of fluid was recovered from the abdominal cavity, and the liver was found to be enlarged and had a nodular appearance on the surface. On sectioning, the liver tissue was found to be firm and fibrous, with multiple nodules of varying sizes throughout the liver parenchyma (Figure 14 d). The nodules were surrounded by fibrous tissue, which had caused scarring and dysfunction of the liver, which occupied most of the hepatic parenchyma. The spleen was pale and of normal size. Necopsy examination of the dog showed multinodular hepatic cirrhosis, but the cause of the condition was not investigated and known due to a lack of laboratory settings.

a) a bitch on first day of presentation, abdominal distension

b) Post mortem examination of the bitch

c) Multinodular hepatic cirrhosis

Figure 14 Hepatic cirrhosis in a bitch

3.2.2.5. Case management and treatment outcome

Before death, the dog was given supportive therapy (abdominal paracentesis by using needles to remove ascitic fluid, administration of Ringer lactate fluid (Addis Pharmaceutical factory PLC, Ethiopia), vitamin B complex, 2ml, IM to improve appetite, and anti-emetic, metoclopramide, 1ml(0.4mg/kg), IV). However, the dog's condition continued to deteriorate, and it died within two days of treatment.

3.2.2.6. Discussion

Hepatic cirrhosis is a serious liver disease that can affect dogs of various ages and breeds. The condition in dogs can be caused by various factors, including chronic hepatitis, toxic liver injury, and copper storage disease. The disease was reported in many countries (Horiguchi et *al*., 2009; Makinde *et al*., 2019; Abalaka *et al*., 2021). However, this is the first case report of the disease in dog in Ethiopia.

This report described the history, clinical signs, laboratory diagnosis, treatment, and treatment outcome of multinodular hepatic cirrhosis in a five-year-old female dog at AAU-CVMA, professor Fisseha G/ab veterinary teaching hospital, Bishoftu.

The dog was presented with a history of lethargy, anorexia, polydipsia, weight loss, ascites, and vomiting. Upon physical examination, the dog had clinical signs of poor body condition, a lethargy, pale mucus membrane, and abdominal distension with fluid. The history and clinical presentation of this case is consistent with typical symptoms of hepatic cirrhosis, such as anorexia, lethargy, weight loss, ascites, vomiting, and distended abdomen (Guidobono *et al*., 2012; Abalaka *et al*., 2021).

Laboratory investigations were performed using blood test (PCV and Giemsa stain), faecal examination (direct smear, simple floatation and sedimentation technique), ascitic fluid test (by physical examination), and post mortem examination. Although the tests used in this case is consistent with other reports, reports by Sevelius (1995), Vijoyanand and Nagarajan (2007), and Abalaka *et al*. (2021), have used additional diagnostic aids like ultrasound and computed tomography (CT) scans, liver biopsy, histopathology, CBC, and urianlysis, which were not used in this case due to limited laboratory settings.

Blood test revealed anaemia (PCV = 30%), and negative results for blood protozoal diseases. Fecal examination showed negative to helminths eggs and protozoal oocysts. Ascitic fluid examination showed transparent and clear fluid indicating ascites. These results are consistent with various case reports (Sevelius, 1995; Vijoyanand and Nagarajan, 2007, Guidobono *et al*., 2012; Abalaka *et al*., 2021)

Postmortem examination revealed that the liver was enlarged and had a nodular appearance on the surface. On sectioning, the liver tissue was found to be firm and fibrous, with multiple

nodules of varying sizes throughout the liver parenchyma. The nodules were surrounded by fibrous tissue, which had caused scarring and dysfunction of the liver. The diagnosis of multinodular hepatic cirrhosis of unknown cause in this case was confirmed by postmortem examination, which revealed a liver parenchyma replaced with fibrous tissue and nodules of varying sizes. This finding is similar to findings of reports on hepatic cirrhosis in dog (Twedt, 2017; Abalaka *et al*., 2021).

Liver disease in dogs can have various causes, including chronic hepatitis, toxic liver injury, and copper storage disease. In this case, the underlying cause of the condition was not determined due to difficulty of understanding the possible causative agent based on the available information or case report data, and limited laboratory settings. This is inline with studies (Vijoyanand and Nagarajan, 2007; Abalaka *et al*., 2021).

The treatment of hepatic cirrhosis in dogs is mainly supportive, and the goal is to manage the clinical signs and prevent further liver damage. In this case report, the dog was treated with supportive therapy; fluid therapy, and medications to manage vomiting (metoclopramide) and improve appetite (vitamin B complex). This is consistent with various case reports (Tzounos *et al*., 2014; Wu *et al*., 2014; Eulenberg and Lidbury, 2018; Makinde *et al*., 2019). However reports by Abalaka *et al*. (2021), and Horiguchi *et al*. (2009), have included prednisolone and hepatocyte growth factor gene therapy, respectively.

In this case, despite treatment, the dog was died on the second day of treatment. This is in line with Abalaka *et al*. (2021), who reported the same outcome. This occurrence of death is more supported by literature. A small animal medicine text book by Twedt (2017), describes that prognosis for dogs with hepatic cirrhosis is guarded, and the disease can progress rapidly, leading to liver failure and death.

In conclusion, this case report highlights the occurrence, clinical signs, and diagnosis, treatment and postmortem findings of hepatic cirrhosis in a dog at AAU-VTH, Bishoftu. The report reaffirms that the prognosis of hepatic cirrhosis is poor and that early recognition and intervention are critical factors for management of the case. Future studies should focus on deep understanding of the case by using different diagnostic aids, identifying the risk factors and underlying causes of hepatic cirrhosis in dogs to develop more effective prevention and treatment strategies.

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3.3. Case Report on Equine

3.3.1. Metacarpal osteomyelitis of a horse

3.3.1.1. Abstract

Osteomyelitis is a bone infection that can occur in horses, and it can affect any bone in the body, including the metacarpal bone. The metacarpal bone, which is located in the front leg of the horse, between the knee and the fetlock joint is commonly affected by Osteomyelitis caused by bacterial infection. The disease, Metacarpal osteomyelitis of horse has been reported in different countries. However, there is no previous case report of the disease in Ethiopia. Hence, this case report was undertaken to describe a metacarpal osteomyelitis infection in a ten-year-old stallion brought to the Society for the Protection of Animals Abroad, Equine hospital on November 10, 2020 with history of decreased working ability, depression, swelling, and lameness in the lower left foreleg. Physical examination of the horse showed clinical signs of depression, staggering gait, poor body condition, Fever pale mucous membranes, and slightly increased heart rate with normal respiratory rates. In addition, lameness of left foreleg, painful and hot swelling on left metacarpal bone and tissue, with abscess was found. The case was tentatively diagnosed as localized abscess, both by tentative and EDDIE app. Diagnostic aid, X-ray was used to identify the swelling of affected metacarpal bone, and it revealed soft tissue swelling around the affected bone, slight destruction of the bone tissue, and irregular bone contour. Microbiological culture of affected tissue revealed staphylococcus bacteria. Finally confirming the case as metacarpal osteomyelitis caused by Staphylococcus bacteria. This revealed inaccurate, but relative diagnosis of Osteomyelitis in horse by EDDIE. A combination of treatment plan, involving antibiotics (Penicillin) and anti-inflammatory drugs (phenyl butazone), were administered. A Horse's condition improved (reduced swelling and lameness), and recovered after three week.

Unfortunately, since the horse was sold by owner after recovery, long term follow up and health check up was not conducted. Generally, this is the first case report on metacarpal osteomyelitis in horse in Ethiopia, and shows the importance of appropriate diagnosis and medication for a successful treatment of the disease.

Key words*:* *Metacarpal Osteomyelitis, Horse, Clinical Sign, X-Ray, Staphylococcus, Treatment, Ethiopia*

3.3.1.2. Introduction

Osteomyelitis is a bone infection that can occur in horses, and it can affect any bone in the body, including the metacarpal bone. The metacarpal bone is located in the front leg of the horse, between the knee and the fetlock joint. Osteomyelitis of the metacarpal bone is commonly referred to as "big knee" in horses (Rose 1978; Smith *et al*., 2022).

The condition can be caused by bacterial or fungal infections, trauma, and exacerbated by compromised immune system.

In horses, osteomyelitis of the metacarpal bone is often associated with injuries to the bone or surrounding tissues, such as puncture wounds or fractures (Sherman *et al*., 2006; Gieling *et al*., 2019; Smith *et al*., 2022).

Osteomyelitis of the metacarpal bone in horses is commonly caused by bacterial infection. The bacteria can enter the bone through a wound or injury to the leg, or it can spread from an adjacent infected area such as a joint or tendon sheath. Once the bacteria enter the bone, they can cause inflammation and destruction of the bone tissue, leading to the formation of an abscess (Goodrich, 2006).

The immune response to the infection can also contribute to the pathogenesis of osteomyelitis. The inflammatory response can cause damage to the surrounding tissues and blood vessels, leading to decreased blood flow to the affected area. This can make it difficult for antibiotics and immune cells to reach the site of infection, making treatment more challenging (Sayegh *et al*., 2001; Gieling *et al*., 2019). In some cases, the bacteria can form a biofilm, which is a protective layer that can make it more difficult for antibiotics to penetrate and kill the bacteria. This can lead to chronic or recurrent infections that are difficult to treat (Balducci *et al*., 2021).

The clinical signs of osteomyelitis of the metacarpal bone in horses can include swelling, pain, heat, and lameness. In severe cases, there may be drainage from the affected area, and the horse may have a fever (Rose, 1978; Tulamo and Alitalo, 1986; Sayegh *et al*., 2001; Goodrich, 2006; Smith *et al*., 2022).

A diagnosis of metacarpal osteomyelitis typically involves a physical examination, diagnostic imaging such as X-rays or ultrasound, and laboratory tests to identify the causative agent (Gieling *et al*., 2019; Balducci *et al*., 2021).

Treatment for osteomyelitis of the metacarpal bone in horses typically involves antibiotics, anti-inflammatory medication, and rest. In severe cases, surgery may be necessary to remove infected tissue or bone. Studies have shown that early diagnosis and treatment are crucial for a successful treatment of the disease (Fraze and Stewart, 2017; Divers and Ducharme, 2018).

Prevention of osteomyelitis of the metacarpal bone in horses involves proper wound care and management of any injuries to the leg.

Regular veterinary care and monitoring can also help to identify any potential issues early on and prevent the development of osteomyelitis (Kohn and Ducharme, 2015; Hillye *et al*., 2017).

Metacarpal osteomyelitis in horse has been reported in different countries in the world (Rose, 1978; Goodrich, 2006; Sayegh *et al*., 2001; Balducci *et al*., 2021). However, there is no single report of the disease in horse in Ethiopia. Therefore, this case report was undertaken to describe the occurrence, clinical signs, diagnosis, treatment and its outcome in a horse diagnosed with Metacarpal osteomyelitis at SPANA equine Hospital.

3.3.1.3. Case Description

On November 10, 2020, a ten year-old local breed stallion was presented to SPANA equine hospital with a history of swelling and lameness, and decreased working ability for a week. The horse was used as a carthorse and kept under shade in the owner's compound. It usually fed concentrate feed (frushka) and grass. It had recent history of deworming, and lameness which resolved without treatment. However, there were no recent change in diet, environment, and work.

On physical examination, the horse had depression, lameness of left forelimb, painful and hot swelling on lower left forelimb(metacarpal bone) with abscess on needle aspiration, fever with a rectal temperature of 38.5^{o}C, poor body condition, pale mucous membranes, and slightly increased heart rate (48 beats/min) with normal respiratory rates (16 breaths/min). In addition, X-ray was used to identify the swelling of left limb metacarpal bone. The x- ray revealed soft tissue swelling around the affected bone, slight destruction of the bone tissue, and irregular bone contour (rough bone with irregular edges). However, all other areas and systems appeared normal.

a) Swollen area of metacarpal bone b) X-ray result (soft tissue swelling around the affected bone, slight destruction of the bone tissue, and irregular bone contour)

Figure 15 Metacarpal osteomyelitis of horse

3.3.1.4. Laboratory Investigation and findings

Laboratory diagnosis of the case involved the bacterial culture to identify the etiology. To collect a sample for bacterial culture, after disinfection of the superficial skin, a deep part of the infected tissue was collected aseptically by fine needle aspiration technique.

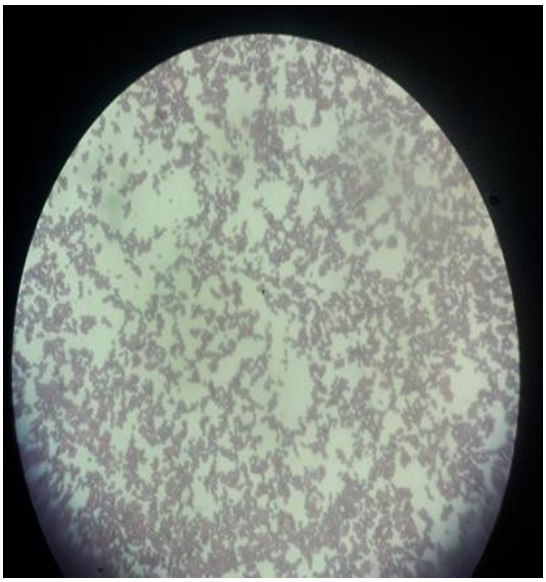
The sample was immediately taken to microbiology laboratory of AAU-CVMA. Then, the sample was streaked on the prepared 5% sheep blood agar, Mannitol Salt Agar media and on McConkey agar and incubated at 37 ^{0}c for 24 hours. After 24 hours of incubation, beta hemolysis seen on blood agar, the colony of grown bacteria was observed on MSA media, while there were no bacteria grown on McConkey agar.

Bacterial culture result showed the growth of circular, smooth, and shiny colonies with yellowish discoloration of the MSA media. Gram staining of the colony showed Gram-positive bacteria (purple color) with cocci-shape, and arranged in clusters. The results of culture revealed the cause of the disease as *Staphylococcus aureus* (It ferment mannitol, yellowish). Based on history, clinical signs, and laboratory diagnosis findings, the case was diagnosed as metacarpal osteomyelitis caused by *Staphylococcus aureus.*

3.3.1.5. Case management and treatment outcome

Treatment for the disease involved a combination of antibiotics and anti-inflammatory medication. On first day, the treatment was initiated by broad-spectrum antibiotic (Penstrep), but changed to penicillin on second day, which continued up to to fifth day after the confirmatory diagnosis. Phenyl butazone, pos was used as anti-inflammatory to decrease inflammatory condition of the disease. In addition, abscess was opened by 20cc syringe, and drained. Then, washed and soaked by savlon and Iodine tincture. Lastly, the owner was advised to give rest, take care of the horse by providing feed and water, and stick to follow up. After a tratement, the horse's condition improved, swelling was reduced, lameness stopped, and the horse became active. According to the owner, the horse attained its full health status after three weeks. Though the owner was asked to bring the horse for check up on one momth after treatment, the horse was sold by the owner fearing that the case might relapse.

a) *Stapylococcus aureus* on blood agar (beta hemolysis) b) *Stapylococcus aureus* on MSA



c) Gram positive, *Stapylococcus aureus*

d) A stallion after recovery

Figure 16 Laboratory investigation of metacarpal osteomyelitis of horse(a-c), and recovery(d)

3.3.1.6. Discussion

Osteomyelitis is a severe and debilitating condition that affects horses, potentially leading to decreased working ability, suffering, and reduced welfare (Kohn and Ducharme, 2015; Hillye *et al*., 2017). This case report describes a case of osteomyelitis diagnosed at AAU-CVMA, SPANA equine hospital in a ten-year-old stallion, which presented with symptoms of swelling and lameness in the lower part of left forelimb, decreased working ability, depression, fever, and poor body condition. X-ray and bacterial culture, aided in the diagnosis of osteomyelitis, and treatment was initiated, involving antibiotics and anti-inflammatory medication. The horse's condition improved, with swelling and lameness stopping, and the horse becoming active again. Based on history and clinical signs, the case was tentatively diagnosed as localized abscess. EDDIE app also diagnosed the case as abscess. Though abscess was one of the finding in this case, the affection of bone should be suspected and the app should have recommended more investigation to confirm the case. These showed the difficulty in diagnosing osteomyelitis of metacarpal bone in horse easily.

The clinical signs described in this case report, including pain, heat, swelling, and poor range of motion of the affected limb, and abscess are consistent with other case reports of osteomyelitis of the metacarpal bone in horses (Divers and Ducharme, 2018; Reef, 2018).

In this case, clinical signs and radiography (X-ray) was used and played a great role in diagnosis of the case. This is in agreement with other case reports (Gieling *et al*., 2019; Balducci *et al*., 2021). According to Balducci *et al*. (2021), a strong clinical diagnosis of osteomyelitis is usually based upon a combination of clinical observations and diagnostic imaging, including radiography, ultrasonography, with CT and MRI. However, CT and MRI was not used in this case due to unavailability of the equipments.

The x- ray result found in this case revealed soft tissue swelling around the affected bone, slight destruction of the bone tissue, and irregular bone contour (rough bone with irregular edges) which indicate inflammation and infection. This is consistent with other similar cases of osteomyelitis in horses (Swinebroad *et al*., 2003; Clegg, 2011).

The laboratory diagnosis of osteomyelitis of the metacarpal bone typically involves bacterial culture and sensitivity testing of the draining sinus or other sources of infection (Anwar *et al*., 1990; Gielding *et al*., 2019). This is consistent with the diagnosis made in this case report. However, sensitivity testing was not done in this case due to unavailability of the antibiotic disc.

In this case, *staphylococcus aureus* was identified as the etiology of the disease. This is in line with (Tulamo and Alitalo, 1986; Orsine, 2017), who reported *staphylococcus aureus* as the cause of osteomyelitis in horse, but in contrast to smith *et al*. (2022), who reported *Clostridium perfringes.*

Treatment of osteomyelitis of the metacarpal bone in horses typically involves a combination of antibiotics, anti-inflammatory medication, and surgery if severe (Divers and Ducharme, 2018). This is consistent with the treatment plan, except surgery, described in this case report. The treatment outcome of this case was successful, which is consistent with (Fraze and Stewart, 2017), who reported the successful treatment of osteomyelitis in horse.

In conclusion, this case report highlights the importance of an appropriate diagnosis and treatment of osteomyelitis, including abscess debridement and administration of appropriate antibiotics, for successful clinical outcomes in horses suffering from metacarpal bone osteomyelitis.

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3.4. Case reports on Ovine

3.4.1. Copper deficiency in a lamb

3.4.1.1. Abstract

Copper deficiency in sheep is a nutritional disorder that occurs when the animal's diet lacks sufficient amounts of copper, or due to excess levels of copper antagonistic minerals such as molybdenum and sulphur. There is very few report on the occurrence of the condition in sheep in Ethiopia. Hence, this case report was conducted to describe the occurrence, clinical signs, diagnosis, and treatment of copper deficiency in a male lamb from Modjo town on November 28, 2022. Physical examination of the lamb revealed a clinical signs of difficulty walking, frequent falls, weakness, depression, incoordination of the hind limbs, and abduction of the hind limbs, and inability to stand. Laboratory investigation of the disease was not conducted due to a limited laboratory settings, except PCV, which revaled anemic condition of the lamb. EDDIE app diagnosed the case as zz-other (meaning that the disease was not specifically mentioned in the

app). Veterinarian working in the study area was consulted about epidemiology of the condition and revealed sporadic occurrence. Finally, the case was tentatively diagnosed based on the history, clinical signs, and epidemiology. Treatment option of the case involved, 0.25% copper sulfate block administered over a four-day period, and a copper supplement in the flock's diet. Two weeks after the treatment, gradual improvements in clinical signs and normal health status of the lamb was attained. Generally, this case report highlights the importance of clinical signs and epidemiology for tentative diagnosis and treatment of copper deficiency in sheep.

Key words: Copper deficiency, Sheep, Clinical Signs, Epidemiology, Treatment, Modjo

3.4.1.2. Introduction

Copper deficiency in sheep is a nutritional disorder that occurs when the animal's diet lacks sufficient amounts of copper. Copper is an essential micronutrient that plays a vital role in many biological processes, including iron metabolism, neurotransmitter synthesis, and connective tissue synthesis. Copper deficiency in sheep and lambs is a common problem that can result in poor growth rates, infertility, anemia, and bone abnormalities (Prohaska and Bailey, 2019).

Copper deficiency can be primary or secondary. Primary copper deficiency occurs due to inadequate levels of cupper in the diet or soil, while Secondary copper deficiency is due to conditioning factors such as excess levels of antagonistic minerals such as molybdenum and sulfur in the diet (Bleken *et al*., 2020; Villar *et al*., 2021).

Copper deficiency in sheep can lead to a range of clinical signs, including anemia, poor growth, reduced fertility, and bone abnormalities. Copper is essential for the formation of hemoglobin, the oxygen-carrying molecule in red blood cells. Without sufficient copper, the animal's ability to produce hemoglobin is impaired, leading to anemia. Copper is also necessary for the development of bones and connective tissues, and a deficiency can result in skeletal abnormalities (Laven and Smith, 2008; Saleh *et al*., 2008; Rong *et al*., 2011).

Diagnosis of copper deficiency in sheep can be challenging, as clinical signs can be similar to other conditions. Blood tests can be used to measure copper levels in the animal's blood, but these tests may not always be accurate. Liver biopsies are considered the most reliable method for diagnosing copper deficiency in sheep (Namazi *et al*., 2020).

Treatment of copper deficiency in sheep involves supplementing the animal's diet with copper. Copper supplements can be administered orally or through injections. In severe cases, blood transfusions may be necessary to treat anemia (Eckert *et al*., 1999; Wu *et al*., 2020).

Prevention of copper deficiency in sheep involves ensuring that the animal's diet contains sufficient amounts of copper. This can be achieved through the use of copper supplements, either in the form of mineral blocks or through injections (Laven and Smith, 2008; Namazi *et al*., 2020). It is also essential to monitor the animal's diet and soil quality regularly to ensure that copper levels are adequate. Additionally, controlling parasitic infections and other factors that can contribute to copper deficiency can help prevent the condition (Saleh *et al*., 2008).

According to Faye *et al*. (1991), Copper deficiency was reported in sheep in the rift valley of Ethiopia. However, there is no recent case report of the disease in sheep in the country, particularly Modjo town. Therefore, this case report was undertaken to describe the occurrence, clinical signs, diagnosis, and treatment of copper deficiency in sheep in Modjo town.

3.4.1.3. Case description

A 6 month-old local breed male lamb with a history of difficulty in walking, frequent falls, and weakness was examined at its owner house in Modjo town, Lume district on November 28, 2022. A lamb had no history of illness, trauma, medication, or vaccination. It was kept extensively with a flock of 4 sheep and fed on grass and feed stubble in the area. Upon physical examination, a lamb had depression, pale mucus membrane, incoordination of the hind limbs, abduction of hind limbs while moving, frequent falls which were exacerbated when the lamb was made to move quickly, inability to get up and stay in standing position (dog-sitting position), as indicated on figures. However, the lamb's vital signs were in normal range (Temperature of 38 ^{0}C, heart rate of 68 beats/min, and respiratory rate of 26 breaths/min) and an examination of other areas of the body and systems revealed no abnormalities.

Furthermore, a veterinarian working in the area was consulted for information on the epidemiolgy of the disease. According to him, such case had been rarely occurring in the area during the dry season and he was tentatively diagnosing the case as copper deficiency. Hence, based on the history, clinical signs, and epidemiology, the case was tentatively diagnosed as Copper deficiency.

3.4.1.4. Laboratory investigation and findings

Although blood tests to assess the concentration of copper in the serum or plasma would help to confirm the disease, the test was not performed due to a lack of blood chemistry analyser that measures copper and other minerals in the blood. However, PCV test was conducted to diagnose the level of anemia of the lamb, and it revealed that the lamb had a PCV value of 23 % (mild anemia).

a) Incoordination of the hind limbs

b) abnormal movement direction

c) abduction of hind limbs while moving

d) frequent falls and dog-sitting position

Figure 17 Clinical signs of copper deficiency in lamb

3.4.1.5. Case management and treatment out come

The lamb was treated with 0.25% copper sulphate block (lick), with a total dose of 4 mg/kg body weight per day over a four-day period. The owner was advised to include a copper supplement in

diet for the other sheep. According to the owner, the lamb showed gradual improvement in clinical signs, and were able to gain its normal health status after two weeks.

3.4.1.6. Discussion

Copper deficiency is a nutritional disorder in sheep, resulting in several adverse effects, including poor growth rates, infertility, anemia, and bone abnormalities (Wu *et al*., 2020). This case report describes a 6-month-old male lamb diagnosed with copper deficiency, presenting with difficulty in walking, frequent falls, depression, pale mucus membranes, incoordination of hind limbs, abduction of hind limbs and weakness. A lamb's vital signs were within normal ranges, and examination of other areas and systems revealed no abnormalities.

In this case, the tentative diagnosis of copper deficiency was made based on the history, clinical signs, and epidemiology of the case. The context of a rare occurrence of similar cases during the dry season in the area provided supportive evidence for the diagnosis. This corroborates the findings of the study by Faye *et al*. (1991), which reported the occurrence of copper deficiency in sheep in the rift valley of Ethiopia and East Africa. Modjo is one of the town in greater rift valley of Ethiopia. Climatic conditions and geo-morphological characteristics of rift valley area, particularly the molybdenum and sulphur excess in the region, seem to account for the marked clinical signs of copper deficiency (Yohannes, 2015).

In most reports on copper deficiency in sheep, blood tests of copper level and liver biopsies were the most commonly used tests for diagnosing copper deficiency in sheep (Rong *et al*., 2011). However, these tests were not performed in this case due to a lack of equipment. However, PCV test revealed that the lamb had mild anemia. This is in agreement with other reports on copper deficiency in sheep, which reported anemia (Laven and Smith, 2008; Saleh *et al*., 2008; Rong *et al*., 2011).

This case was managed successfully with oral administration of copper sulfate for four days. This is in line with other reports on succesful treatment of copper deficiency in sheep by copper sulfate (Eckert *et al*., 1999; Wu *et al*., 2020).

In conclusion, this case report highlights the importance of proper nutrition for sheep and how copper deficiency can cause health problems in sheep. It also emphasizes the need for laboratory

equipments to confirm the diagnosis of copper deficiency to ensure proper diagnosis and treatment.

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3.4.2. Hypocalcemia in Ewe

3.4.2.1. Abstract

Hypocalcemia is a common metabolic disorder that affects sheep, particularly during pregnancy and lactation. It is also known as milk fever or parturient paresis. Low blood calcium levels are the cause of the condition, and it manifests clinically as weak, poorly functioning muscles. This case report describes a 4-year-old ewe brought to AAU-CVMA Professor Fiseha G/ab VTH on January 5, 2023, with symptoms of weakness, decreased feed and water intake, and difficulty standing, which were worsening in severity. The animal was diagnosed with hypocalcemia based on its history, clinical signs, and stage of pregnancy, and potential differential diagnoses, such as pregnancy toxaemia and hypomagnesemia were considered. Blood tests were not performed due to limited laboratory settings. The ewe was treated with IV calcium borogluconate and supportive therapy with multivitamins. The owner was also advised to incorporate calcium into the ewe's diet, and the animal recovered with in few minutes. Generally, hypocalcemia is a common metabolic disorder in pregnant and lactating ewes, an appropriate diagnosis and treatment with calcium supplementation are essential for a successful treatment outcome.

Key words: Hypocalcemia, Ewe, Clinical Signs, Calcium Borogluconate, Bishoftu

3.4.2.2. Introduction

Hypocalcemia is a common metabolic disorder that affects sheep, particularly during pregnancy and lactation. It is also known as milk fever, although it is not related to fever as the name

suggests. Hypocalcemia in sheep is a condition caused by low blood calcium levels, usually, when the total serum calcium concentration is less than 11.5 mg/dL (Mostaghni *et al*., 2012).

In pregnant ewes, the demand for calcium increases, especially in the last months of gestation, as the developing fetus requires the mineral for bone formation. This can lead to a negative calcium balance, where calcium is taken from the maternal bones to meet the fetal needs. In lactating ewes, calcium loss through milk production can exacerbate the condition (Marques *et al*., 2011).

A diet deficient in calcium or an imbalance between the calcium and phosphorus ratio is often a primary cause of hypocalcemia in sheep. Other factors that can contribute to the development of hypocalcemia include over conditioning, lack of exercise, and breed susceptibility.

In addition, hypocalcemia can also be associated with other metabolic disorders, such as pregnancy toxemia, hypomagnesemia, and ketosis (Smith, 2009).

Clinical signs of hypocalcemia in sheep may include muscle tremors, weakness, incoordination, recumbence, and difficulty standing. In severe cases, it can lead to coma or death, if left untreated. Generally, hypocalcemia has three stages, with stage 1 characterized by the animal being able to stand, stage 2 by recumbency, and stage 3 by coma and unresponsiveness (Peek and Divers, 2008; Oetzel and Goff, 2009; Brozos *et al*., 2011; Constable *et al*., 2017).

The early stages of hypocalcemia in affected ewes can be manifested by isolation from the flock, unable to raise themselves from their knees and assume sternal recumbency again within 10–30 seconds. Over the next 2–6 hours the ewe becomes depressed, weak and unable to stand even when supported. Later the rumen distended and contents expelled with green fluid on the external nares and around the lower jaw, which is the indication of advancement (Bulgin, 2007; Brozos *et al*., 2011).

Management of hypocalcemia in sheep involves addressing the underlying cause, providing IV calcium borogluconate, and supportive care (Smith, 2009).

Prevention of hypocalcemia through dietary supplementation with calcium and balancing of calcium and phosphorus ratio is key to avoiding the condition in sheep (Brozos *et al*., 2011).

Generally, hypocalcemia is a common metabolic disorder in pregnant and lactating ewes, and an appropriate diagnosis and treatment with calcium supplementation are essential for a successful

treatment outcome. Hence, this case report was undertaken to describe the occurrence, clinical signs, diagnosis, and treatment of Hypocalcemia in ewe brought to brought to AAU-CVMA Professor Fiseha G/ab VTH, Bishoftu, Ethiopia.

3.4.2.3. Case description

A 4-year-old local breed ewe weighing about 50 kg was brought to AAU-CVMA Professor Fiseha G/ab VTH from Bishoftu town on January 5, 2023, The animal was presented with a history of weakness, decreased feed and water intake, and difficulty standing. The ewe had been showing those symptoms for the past two days with increasing severity. The owner also said that the ewe was about to give birth (last month of pregnancy) and had previous history of similar signs during the previous pregnancy (7 months ago), and had been given medications which resolved the case. The ewe was housed in a compound with other 25 sheep, never vaccinated for any diseases, and fed hay and grass, with occasional supplementation of frushka (concentrate feed). Up on physical and clinical examination, the ewe was found depressed, unable to stand, trembling of the hind limb muscles, mucous membranes were pale, and had increased heart rate (104 beats/min) and respiratory rates (36 breaths/min). However, the animal's rectal temperature was normal (37.2 ^{0}c), had good body condition, and all other areas and systems were normal.

Based on history, clinical signs, and stage of pregnancy, the case was tentatively diagnosed as calcium deficiency, and potential differential diagnosis of the case, such as Pregnancy toxaemia and hypomagnesemia were listed. Although blood tests to assess the concentration of calcium in the serum or plasma would help to confirm the disease, the test was not performed due to limited laboratory settings.

a) The ewe was depressed and unable to stand b) the ewe was able to stand, defecate, and start moving

Figure 18 Clinical sign and treatment outcome of hypocalcemia in ewe

3.4.2.4. Case management and treatment out come

The ewe was treated with a calcium borogluconate, 30 mL, IV, slowly, stat. Then, after ten minutes of the treatment, the ewe was able to stand, defecate, urinates and start walking. Therefore, based on the treatment outcome and exhibited signs, it was confirmed that the ewe was suffering from hypocalcaemia. The ewe was also given multivitamin, 2ml, IM as supportive therapy. The owner was advised to include calcium in diet for the ewe and other sheep.

3.4.2.5. Discussion

Hypocalcemia, also known as milk fever, parturient paresis, is a common metabolic disorder in pregnant and lactating ewes. This case report describes a case of hypocalcemia in a 3-year-old ewe presented with a history of lethargy, anorexia, and recumbency.

On physical examination, the ewe was found to be weak and unable to stand. The rectal temperature was within normal limits, and there were no signs of respiratory distress or abnormal heart sounds. However, the ewe had a low heart rate and weak peripheral pulses. EDDIE app

diagnosed the case as zz-other (meaning that the disease was not specifically mentioned in the app). Other case reports and literature published before revealed similar clinical signs in cases of hypocalcemia in sheep (Brozos *et al*., 2011; Marques *et al*., 2011; Constable *et al*., 2017).

In this case, diagnosis was made based on history, clinical signs, and response to treatment. Based on these findings, a diagnosis of hypocalcemia was made. This is in line with other reports, which showed that the diagnosis of hypocalcemia can be done based on history, clinical signs, and response to treatment (Marques *et al*., 2011). However, literature and some reports have showed that diagnosis of the case could be confirmed well by using blood tests to assess the concentration of calcium in the serum or plasma (Mostaghni *et al*., 2012; Constable *et al*., 2017).

Treatment of the case was done with intravenous administration of calcium borogluconate and oral calcium supplementation. The ewe recovered with in few minutes. This protocol and outcome is in agreement with literature and reports (Constable *et al*., 2017; Brozos *et al*., 2011).

In conclusion, hypocalcemia is a common metabolic disorder in pregnant and lactating ewes. Appropriate diagnosis and treatment with calcium supplementation are essential for a successful outcome.

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3.4.3. Colibacillosis in Lambs

3.4.3.1. Abstract

Colibacillosis is a bacterial disease caused by *Escherichia coli*, a gram-negative bacteria that commonly affects livestock including sheep. This case report describes colibacillosis in two female lambs that were brought to the Modjo veterinary clinic on February 6, 2021, with a history of diarrhea, anorexia, and lethargy for 3 days. Upon physical examination, both lambs were found to be dehydrated and had a fever (rectal temperature of 39 ^{0}C). They were also lethargic, and one of them was recumbent and unable to move. In addition, the lambs had an increased heart rate of 96 beats per minute, an increased respiratory rate of 32 breaths per minute. They also had pale mucus membranes, soiled perineum and tail with feces. EDDIE app diagnosed the case as Colibacillosis. Laboratory investigation of the disease also confirmed the case as colibacillosis (with cultures identifying *Escherichia coli* as the causative agent), indicating accuracy o EDDIE app in diagnosing Colibacillosis in lambs. The lambs were treated with Oxytetracycline, and their condition significantly improved within three days of treatment. The case highlights the importance of thorough laboratory investigation in confirming diagnosis, which allows for targeted and effective treatment. In addition, good hygiene, nutrition, and management practices can prevent the spread of the disease and improve overall animal health and productivity.

Key words: Colibacillosis, *Escherichia coli*, lambs, Modjo

3.4.3.2. Introduction

Colibacillosis is a bacterial disease caused by Escherichia coli, a gram-negative bacteria that commonly affects livestock including sheep. The disease can present in different forms and

clinical manifestations, ranging from enteric and respiratory diseases to sepsis and mastitis, leading to significant morbidity and mortality rates in young animals (Sonawane *et al*., 2012).

Colibacillosis is the most important bacterial cause of diarrhoea in lambs during the first few weeks of life. While septicaemia is caused by certain invasive serotypes of enterotoxigenic *E. coli* (ETEC) that possess virulence properties which enables them to cross the mucous membranes of intestines, nasopharynx, crypts of tonsils or umbilical veins . They also have the ability to resist the hosts' defence mechanisms following invasion and produce bacteraemia and septicaemia. *E. coli* is widely distributed in nature; being present in soil, surface water, animal and human faeces. *E. coli* produces septicemia and diarrhea in a wide range of hosts including man, avian and animals (Jesse *et al*., 2016).

Clinical signs of colibacillosis in lambs and sheep may include fever, lethargy, anorexia, and diarrhea, which can range from mild to severe and may lead to dehydration, acidosis, and septicaemia (Hassan *et al*., 2014).

Diagnosis is based on history and clinical findings, bacterial culture, demonstration of a severe deficiency of circulating IgG, serological test and ultimately, demonstration of the organism in blood or tissues; biochemical analysis is also of good help. The differential diagnosis of colibacillosis are: coccidiosis, Rotavirus, Coronavirus, Cryptosporidia and salmonellosis (Bashahun and Amina, 2017).

The treatment and management of colibacillosis in lambs and sheep typically involve the administration of broad-spectrum antibiotics and the correction of dehydration and electrolyte disturbances. Prevention is mainly achieved through good hygiene practices, including proper sanitation, vaccine use, proper nutrition, and management of stress factors, amongst others. (Willayat *et al*, 2000).

Colibacillosis is a common cause of lamb mortality in Ethiopia. Hence, this case report was undertaken to describe the occurrence, clinical signs, diagnosis, and treatment of Colibacillosis in two lambs brought to Modjo veterinary clinic.

3.4.3.3. Case Description

Two female lambs of a local breed, both aged 2.5 months, were brought to the Modjo veterinary clinic on February 6, 2021 with a history of diarrhea, anorexia, and lethargy for the past 3 days. The lambs had no previous history of illness, medication, or vaccination. They were nursing from their mother but were also being fed fresh green grass and hay. They were raised in a small flock of 8 sheep and kept semi-intensively. Upon physical examination, both lambs were found to be dehydrated and had a fever (rectal temperature of 39 ^{0}C). They were also lethargic, and one of them was recumbent and unable to move. In addition, the lambs had an increased heart rate of 96 beats per minute, an increased respiratory rate of 32 breaths per minute.

They also had pale mucus membranes, soiled perineum and tail with feces. However, all other areas, lymph nodes, and systems were normal.

Based on history and clinical signs, differential diagnosis including Colibacillosis, Salmonellosis, coccidiosis, Pasteurellosis, Clostridial infections, Gastro-intestinal parasitism, and Rotavirus infection were listed. Among these, colibacillosis was tentatively diagnosed.

3.4.3.4. Laboratory Investigation and Findings

For definitive diagnosis of the case, fecal samples were collected with sterile glove from the rectum of the lambs into sterile sample container. The collected samples were labeled, packed and transported along with ice packs, in ice box to Microbiology and Parasitology laboratory of AAU-CVMA, Bishoftu. About 1 gram of the sample from each lambs were enriched into 9ml of enrichchment media (nutrient broth), while other 1 gram of each samples were enriched into 9ml of enrichment media for Salmonella (Rappaport broth) to rule out Salmonella (salmonella grow on Rappaport). Then, incubated at 37 °C for 24hrs. On the following day the enriched samples were checked for growth. No growth was seen on Rappaport (ruled out Salmonella), while cloudiness (increased turbidity) of nutrient broth was seen. A loop full of enriched fecal samples in nutrient broth were then cultured on macConkey agar and incubated at 37 °C for 24hrs.

After 24 hours of incubation, growth was observed on the macConkey agar. Then, the growth from the macConkey agar was sub cultured on nutrient agar medium and EMB (Figure). The

gram's staining was performed from the pure colony on the nutrient agar. Gram stain result revealed gram-negative, rod-shaped bacterium, *E. coli.*

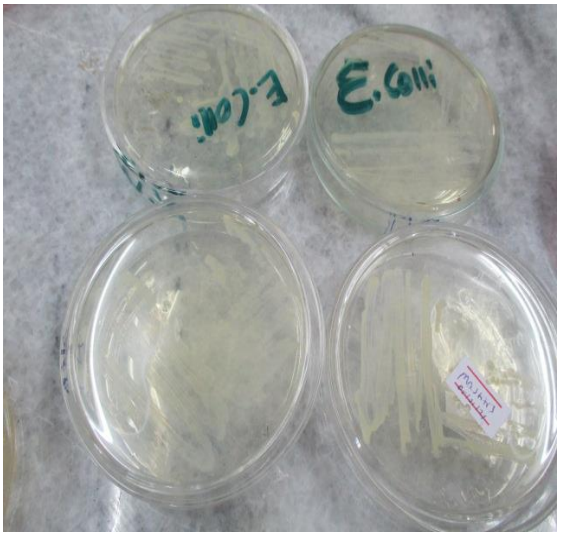
Finally, it was concluded based on the growth patterns and Gram‟s stain results that the bacterium responsible for the case was *E.coli*, and the disease was confirmed as colibacillosis.

In addition to culture, fecal floatation technique and sedimentation technique were also conducted at parasitology laboratory. The results of the tests were negative (ruled out GIT parasites and coccidiosis).

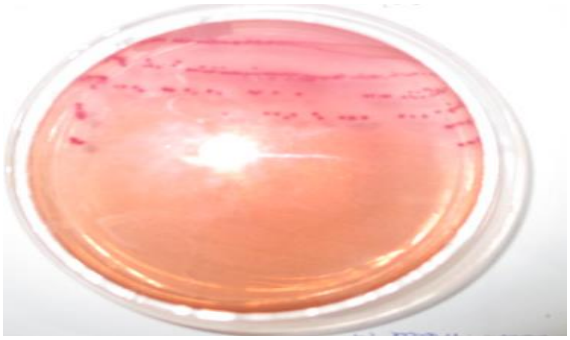
a) The presented lambs

b) diarrhea

c) Diarrhea



d) *E.coli* on nutrient agar



e) E.coli on McConkey agar

f) E.coli on EMB agar

Figure 19 Clinical Signs and confirmatory diagnosis of colibacillosis in sheep lambs

3.4.3.5. Case Management and Treatment Out Come

Treatment was initiated with antibiotics, Oxytetracycline 10% (Shanghai Thongren Pharmaceutical Co., Ltd., China) at a dose of 1 ml per 10kg, IM, per day for 3 days. After three days of treatment, the lambs clinical signs improved, diarrhea stopped, and they recovered.

3.4.3.6. Discussion

Colibacillosis is a disease caused by *E. coli*, a bacterium that normally inhabits the intestinal tract of animals. The disease is characterized by enteric and extra-enteric manifestations, depending on the virulence factors of the bacteria, the age and immune status of the animal, and environmental conditions. In lambs, colibacillosis is a common cause of diarrhea, as their immune system is weak. In addition, factors such as poor hygiene, inadequate colostrum intake, and nutritional imbalances can contribute to the development of the disease (Du, 2007).

This case described a case of colibacillosis in two 2.5-month-old lambs. The lambs exhibited clinical signs of diarrhea, anorexia, lethargy, and dehydration. These clinical signs are in line with other reports on colibacillosis in lambs (Sonawane *et al*., 2012). In the study by Jesse *et al*. (2016), the case of colibacillosis was presented with diarrhea, anorexia, and fever. Some of the lambs also had abdominal distension and dehydration, which are not mentioned in the case report described.

EDDIE app diagnosed the case as Colibacillosis. Laboratory investigation of the disease also confirmed the case as colibacillosis (with cultures identifying *Escherichia coli* as the causative agent), indicating accuracy o EDDIE app in diagnosing Colibacillosis in lambs. This procedure

and result is in line with reports on colibacillosis in lambs (Tikoo and Soodan, 2009). While the laboratory investigation in the case report described was limited only to bacterial culture, the addition of sensitivity testing and PCR would have provided valuable information for the diagnosis and treatment of the case.

In this case report, the lambs were treated with the broad-spectrum antibiotic, Oxytetracycline, and recovered after three days of treatment, which is in agreement with the treatment recommended by constable *et al*. (2017).

In conclusion, early diagnosis and treatment of colibacillosis in lambs are crucial to prevent severe morbidity and mortality. Prevention of the disease in lambs can be achieved through good hygiene practices, appropriate colostrum management, and adequate nutrition.

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3.4.4. Orf in A Lamb

3.4.4.1. Abstract

Contagious ecthyma or orf is a highly contagious viral disease affecting domesticated and wild ruminants, including sheep. This case report describes a 3-month-old lamb that was presented at Modjo veterinary clinic on February 2, 2021, with history of inappetence and scabs on the lip for the past 2 weeks. Upon physical examination, a lamb had dry and painful thick scabby lesions on both lower and upper left lip, fever, increased heart rate of 96 beats per minute, and an increased respiratory rate of 32 breaths per minute. In addition, the lamb was depressed, and had pale mucus membrane, swollen submandibular and retropharyngeal lymphnodes. Based on history, and pathognomic clinical signs, the case was diagnosed as Contagiuos Ecthyma and its differential diagnosis, such as pox and ppr were listed. EDDIE app also diagnosed the case as Contagious Ecthyma. The lamb was given 20% Oxytetracycline, 20mg/kg, IM, stat to prevent secondary bacterial infections. In addition, the scab on the lip were cleaned by savlon and 2% iodine tincture to prevent bacterial infection of the scab and papules. Moreover, due to the zoonotic importance of the disease, the owner was advised to wear gloves and take care while handling the sheep and isolate it from the rest of the flock to prevent transmission of the virus to other animals or humans. The owner reported that after three weeks, the lamb had fully recovered. No transmission of the virus to either human or other animals was recorded. The owner was also advised to vaccinate their small ruminants.

Keywords: *Contagious Ecthyma, lamb, diagnosis, clinical signs, treatment, Oxytetracycline*

3.4.4.2. *Introduction*

Contagious ecthyma, commonly known as Orf, is a highly contagious viral disease affecting domesticated and wild ruminants such as sheep, goats, and deer. The disease is caused by the Orf virus, which is a member of the Poxviridae family. Orf is characterized by the development of papules and scabs on the lips, udders, and teats of affected animals, which can cause discomfort and reduce productivity (Nougairede et al., 2013). The Orf virus is a double-stranded DNA virus that primarily infects the skin and mucous membranes of sheep, goats, and other ruminants. The virus is highly resistant and can survive in the environment for prolonged periods.

The virus enters the skin through small abrasions or lesions, where it replicates and causes the development of papules and scabs. The virus eventually spreads to other areas of the body and can cause multiple lesions, particularly in areas of the body with thin skin, such as the lips, udders, and teats (Banyard *et al*., 2014).

Orf is present worldwide and is particularly common in areas with high concentrations of sheep and goats. The virus survives in the environment for prolonged periods, making it a risk for both direct and indirect transmission through contact with contaminated fomites or infected animals (Ozturk *et al*., 2012).

Clinical signs of Orf in sheep and goats typically include the development of papules and scabs on the lips, udders, and teats. The lesions can cause discomfort and pain, leading to reduced productivity. Affected animals may also exhibit fever, lethargy, and anorexia. In severe cases, the virus can cause systemic disease and even death (Zhang *et al*., 2020).

There is currently no specific treatment for Orf, and management generally involves the use of topical disinfectants to prevent secondary bacterial infections and reduce pain. Animal handlers should observe good hygiene practices to prevent the spread of the virus, such as wearing gloves while handling infected animals and isolating infected animals from the rest of the flock. Vaccination is also available in some countries and can provide immunity to the disease (Spyrou and Valiakos, 2015).

3.4.4.3. Case Description

A 3 month-old local breed male lamb was brought to the Modjo veterinary clinic on February 2, 2021, with a history of inappetance and scabs on the lip for the past 2 weeks. A lamb had no previous history of illness, medication, or vaccination. It was nursing its mother and also started feeding grass and concentrate feed (frushka). A lamb was raised by its mother with 2 other lambs in a small flock of six sheep and kept semi-intensively. Upon physical examination, a lamb had dry and painful thick scabby lesions on both lower and upper left lip as indicated on figure. It had had a fever (rectal temperature of 39 ^{0}C), increased heart rate of 96 beats per minute, and an increased respiratory rate of 32 breaths per minute. In addition, the lamb was depressed, and had pale mucus membrane, swollen submandibular and retropharyngeal lymphnodes. However, all

other areas, and systems were normal. The smart Phone EDDIE also diagnosed the case as orf/contagious ecthyma.

Based on history and clinical signs, differential diagnosis including contagious ecthyma (orf), wound on the lip, and contagious pustular dermatitis were listed. Among these, Orf was tentatively diagnosed based on the pathognomonic sign of the disease. Laboratory invsetigation could not be carried out due to the unavailability of sample collection materials on that day.

Figure 20 Orf in a lamb

3.4.4.4. Case Management and Treatment Outcome

The lamb was given 20% Oxytetracycline, 20mg/kg, IM, stat to prevent secondary bacterial infections. In addition, the scab on the lip were cleaned by savlon and 2% iodine tincture to prevent bacterial infection of the scab and papules.

Moreover, due to the zoonotic importance of the disease, the owner was advised to wear gloves and take care while handling the sheep and isolate it from the rest of the flock to prevent transmission of the virus to other animals or humans. Three days after of treatment, the lamb was brought to modjo veterinary clinic and it was found that the scab had fallen off and the papules were treated with Savlon and Iodine tincture. The owner reported that after three weeks, the lamb

had fully recovered, becoming active and able to graze. In addition, no tranismission to people or animal were recorded.

3.4.4.5. *Discussion*

Contagious ecthyma, commonly known as Orf, is a viral disease caused by the Orf virus and affects various domesticated and wild ruminants. In this report, a case of Orf in a 3-month-old male lamb with a history of inappetence and thick scabby lesions on the lip was described.

The lamb was diagnosed with Orf based on the pathognomonic signs of the disease, which included scabs and papules on the lip. In addition, other clinical signs, such as fever, increased heart rate, increased respiratory rate, depression, pale mucus membrane, swollen submandibular and retropharyngeal lymphnodes were recorded. The signs were in agreement with the report of Abbas and Mughal (2014), Spyrou and Valiakos (2015), and Sadiqma *et al*. (2017).

Although laboratory investigations are crucial in confirming the diagnosis of Orf, they were not conducted in this case due to unavailability of sample collection materials on the date of the case presentation. The case was diagnosed only tentatively and by EDDIE app (diagnosed the case as Contagious Ecthyma). This is in line (tentative diagnosis) with Abbas and Mughal (2014). However, in contrast to reports by Yeshwas *et al*. (2014), and Spyrou and Valiakos (2015), which confirmed the case by PCR.

The management and treatment of Orf include isolation of the infected animal, management of secondary bacterial infections, and cleaning and disinfection of lesions to prevent bacterial infections. These measures were carried out in the present case. The lamb was treated with Oxytetracycline to prevent secondary bacterial infections, and the owner was advised about zoonotic importance of the disease, and to wear gloves while handling the animal and isolate it from the rest of the flock to prevent transmission of the virus. This approach is in agreement with reports on orf in sheep (Leavell *et al*., 1968; Yeshwas *et al*., 2014; Sadiqma *et al*., 2017).

In this case, the lamb had fully recovered from the disease after three weeks and no tranismission to people or animal were recorded. This is in line with reports by Abbas and Mughal (2014), and Billinis *et al*. (2012), which reported the recovery of sheep from orf with in weeks. However, in contrast to Leavell (1968), and Nougairede *et al*. (2013), which reported the tranismission of orf to people.

In conclusion, Orf is a viral disease that affects various ruminants, including sheep. Mangement of the disease involves measures such as isolation of infected animals, management of secondary bacterial infections, and disinfection of lesions. Animal handlers should be aware of the zoonotic importance Orf to prevent the tranismission of the disease.

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3.4.5. Unsuccessful Treatment of a Suspected Case of Listeriosis in a Ram

3.4.5.1. Abstract

Listeriosis is a bacterial disease that can affect domestic and wild animals, including sheep, and can result in severe neurological symptoms with high morbidity and mortality rates. This case report describes a 3-years-old ram that was presented to Modjo veterinary clinic on February 2, 2021, with history of circling, depression, anorexia, and head pressing. Upon physical examination, a ram had depression, fever, inceased respiratory rate of 24 breaths per minute, and a heart rate of 90 beats per minute. The ram was also observed to be circling to the left, with a head tilt. Based on history and clinical signs, differential diagnosis of the condition, coenurus cerebralis, listeriosis, and nasal bots were listed. Among these, listeriosis was tentatively diagnosed considering the age of the animal, severity of the disease, and clinical signs manifested. The smart Phone EDDIE app also diagnosed the case as listeriosis. Laboratory invsetigation of the case could not be carried out due to the unavailability of appropriate bacteriological media to isolate the pathogen. Finally, the ram was prescribed 10% Oxytetracycline (16.5 mg/kg per day for consecutive five days, IV). In addition, Glucose 40 %(1 ml/kg at 0.5 ml/kg/hour, IV), multivitamin (10ml, IM, stat) were also administered as supportive therapy. In addition, the owner was advised about the zoonotic importance of the disease and not to slaughter the ram for human consumption. Despite the treatment with antibiotics and supportive therapy, the ram died on the following day. Generally, listeriosis should be considered as a differential diagnosis in sheep presenting with neurological signs. Since prognosis of the disease is guarded, early diagnosis and treatment should be conducted.

Key words: *Listeriosis, Physical Examination, EDDIE App, Treatment*

3.4.5.2. Introduction

Listeriosis is a bacterial disease caused by Listeria monocytogenes that affects a wide range of domestic and wild animals, including sheep. The disease is characterized by severe neurological symptoms, such as ataxia, circling, and head pressing, and can result in high morbidity and mortality rates. Listeriosis is also a zoonotic disease that can be transmitted to humans through the consumption of contaminated animal products. This literature review aims to provide an overview of the epidemiology, clinical signs, diagnosis, treatment, and prevention of listeriosis in sheep (Atilola and Olugasa, 2016).

Listeria monocytogenes is a ubiquitous bacterium that can be found in soil, water, and vegetation. Sheep become infected with L. monocytogenes by ingesting contaminated feed or water or by inhaling contaminated dust or aerosols. The bacteria can also enter the body through skin wounds or the reproductive tract. Sheep are more susceptible to listeriosis during the winter months when they are fed silage or haylage contaminated with L. monocytogenes. Outbreaks of listeriosis in sheep are often associated with poor silage management practices, such as inadequate fermentation, poor sealing, and improper storage (Wagner *et al*., 2005).

Listeriosis in sheep is characterized by neurological symptoms that include depression, ataxia, circling, head pressing, blindness, and paralysis. The disease can also cause fever, anorexia, and weight loss. The severity of clinical signs depends on the site of infection and the extent of bacterial dissemination. Sheep with listeriosis usually die within 2-3 days of the onset of clinical signs (Haligur *et al*., 2019)

The diagnosis of listeriosis in sheep is based on clinical signs, post-mortem examination, and laboratory tests. Clinical signs are suggestive of listeriosis but are not specific to the disease. Post-mortem examination can reveal characteristic lesions in the brainstem and meninges, including congestion, hemorrhage, and inflammation. Laboratory tests, such as bacterial culture and PCR, can confirm the presence of L. monocytogenes in tissue samples (Wesley *et al*., 2002).

Treatment of listeriosis in sheep is often unsuccessful due to the rapid progression of the disease and the poor response to antibiotics. Antibiotics, such as penicillin and ampicillin, are the drugs of choice for treating listeriosis in sheep (Sadeghian *et al*., 2020).

However, treatment should be initiated early in the course of the disease to have any chance of success. Supportive care, such as fluid therapy and nutritional support, may also be necessary to improve the animal's condition (Braun *et al*., 2002).

Prevention of listeriosis in sheep involves good silage management practices, such as proper fermentation, sealing, and storage. Silage should be tested for pH and bacterial content before feeding to sheep. Sheep should also be provided with clean water sources and protected from contaminated dust and aerosols. Vaccination against listeriosis is available for sheep but is not commonly used due to the low incidence of the disease (Sadeghian *et al*., 2020).

3.4.5.3. Case Description

A 3-year-old black colored local breed ram weighing about 40kg was presented to the modjo veterinary clinic February 2, 2021, with a history of circling, depression, anorexia, and head pressing for the past 24 hours. The ram was part of a flock of fifteen sheep, and no other animals had shown similar symptoms. The ram had been fed with grasses, and had not been vaccinated against any diseases. It had no previous history of illness, and no medication had been administered.

On physical examination, the ram was found to be depressed, with fever (a rectal temperature of 39.5 °C), respiratory rate of 28 breaths per minute, and a heart rate of 90 beats per minute. The ram was also observed to be circling to the left, with a head tilt. The sheep's lymph nodes were normal and no other abnormalities were detected. Based on history and clinical signs, differential diagnosis of the condition, coenurus cerebralis, listeriosis, and nasal bots were listed. Among these, listeriosis was tentatively diagnosed considering the age of the animal, severity of the disease, and clinical signs manifested. The smart Phone EDDIE app also diagnosed the case as listeriosis.

Laboratory invsetigation of the case could not be carried out due to the unavailability of appropriate bacteriological media to isolate the pathogen.

Figure 21 Clinical sign of listeriosis in a ram (circling)

3.4.5.4. Case Management and Treatment Outcome

The ram was prescribed 10% Oxytetracycline (16.5 mg/kg per day for consecutive five days, IV), and took its first treatment on the day of presentation. In addition, Glucose 40 %(1 ml/kg at 0.5 ml/kg/hour, IV), multivitamin (10ml, IM, stat) were administered as supportive therapy. However, despite the treatment, the ram was died on the following day. The owner was advised the zoonotic importance of the disease, and to take precaution during handling the animal and also not to slaughter the ram for human food.

3.4.5.5. Discussion

Listeriosis is caused by Listeria monocytogenes, a bacterium that affects both domestic and wild animals. This disease is known for its severe neurological symptoms such as circling, ataxia and head pressing, which can lead to high mortality rates in affected animals. It is also a zoonotic disease, capable of being transmitted to humans through the consumption of contaminated animal products (Constable *et al*., 2017; Sadeghian *et al*., 2020: Ribeiro *et al*., 2022).

This case report describes a case of listeriosis in a 3-year-old black-colored local breed ram at Modjo veterinary clinic. The ram was presented with symptoms of depression, fever, tachycardia, head pressing, circling, and a head tilt. The identified signs were in agreement with the report by Wesley *et al*. (2002), Wagner *et al*. (2005), and Ribeiro *et al*. (2022).

Confirmatory diagnosis of listeriosis in sheep involves the isolation and identification of *Listeria monocytogenes* bacteria from the tissues of the infected animal or from fluid samples such as blood, cerebrospinal fluid, or abdominal fluid (Wesley *et al*., 2022; Constable *et al*., 2017). Unfortunately, isolation of the bacteria could not be performed in this case due to unavailability of listeria media. This led to diagnosing the case tentatively. The smart Phone EDDIE app also diagnosed the case as listeriosis, indicating the match with tentative diagnosis. To diagnose the case, differential diagnosis of the condition (*Coenurus cerebralis*, listeriosis, and nasal bots) were listed first based on history, epidemiology, and presented clinical signs. Accordingly, the case was tentatively diagnosed as listeriosis by taking factors, such as the age of the animal, severity of symptoms, and clinical signs. Coenurus cerebralis was ruled out due to its tendency to commonly occur in young animals (Achenef *et al*., 1999; Scala and Varcasia, 2006; Miran *et al*., 2015). Nasal bots was ruled out due to the absence of nasal bot Symptoms (sneezing and nasal discharge) (Yilma and Genet, 2000; Allaie *et al*., 2016).

The treatment given to the ram involved the use of 10% oxytetracycline, glucose, and multivitamins as supportive therapy. This is in line with treatment protocol recommened in literatures and case reports on listeriosis (Constable *et al*., 2017; Sadeghian *et al*., 2020: Ribeiro *et al*., 2022).

Considering the zoonotic importance of listeriosis, the owner was advised to take precaution during handling the animal and also not to slaughter the ram for human consumption. This is supported by reports on tranismission of listeriosis from animals to human (Wagner *et al*., 2005; Zelenik *et al*., 2014; Wesley *et al*., 2022).

Death was the treatment out come of this case (a ram died on the following day of treatment). This is supported by literatures and case reports, which described the guarded prognosis of clinical listeriosis in sheep (Nyyssönen *et al*., 2006; Constable *et al*., 2017; Ribeiro *et al*., 2022). However, in contrast to Kumper (1999), and Braun *et al*. (2002), who reported the succesful treatment of listeriosis in sheep.

In conclusion, listeriosis should be considered as a differential diagnosis in sheep presenting with neurological signs. Since prognosis of the disease is guarded, early diagnosis and treatment should be conducted.

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3.4.6. Sheep pox

3.4.6.1. Abstract

Sheep pox is an important viral disease that affects sheep. It is caused by sheep pox virus, a member of the Capripoxvirus genus of the Poxviridae family. This case report describes a 3-years-old ram that was presented to Modjo veterinary clinic on December 5, 2022 with history of nodules on the skin, depression, and inappetence. Up on physical examination, the sheep was found to be depressed and febrile with a rectal temperature of 39.2°C, had lameness on right hind limb and small raised nodules on the skin of the right cheek, left limb, and ventral part of the tail. In addition, the sheep had slightly increased heart (82) and respiratory rates (34 breaths/minute). Based on history, and clinical signs, the case was tentatively diagnosed as sheep pox. EDDIE app also diagnosed the case as sheep pox, indicating the match with tentative diagnosis made. The

ram was treated with Oxytetracycline to prevent secondary bacterial infections. The owner reported that the animal recovered fully in a month, and appropriate precautions were advised to owner considering the zoonotic importance of the disease.

Key words: *Sheep Pox, Physical Examination, Clinical Signs, Diagnosis, Treatment*

3.4.6. 2. Introduction

Sheep pox is an important viral disease that affects sheep and goats. It is caused by sheep pox virus, a member of the Capripoxvirus genus of the Poxviridae family. Sheep pox is characterized by fever, vesicular eruptions, and inflammation of the respiratory and lymphatic systems. The disease is found throughout much of Africa, Asia, and the Middle East, and it causes significant economic losses in affected areas (Mondal *et al*., 2004).

Transmission of the virus can occur through direct contact between animals or through contact with contaminated fomites. The virus can also survive for long periods in the environment, and indirect transmission through vectors such as mosquitoes, flies, and ticks is a significant concern in some regions. The incubation period for sheep pox can range from 5 to 14 days, and clinical signs typically appear after the incubation period (Ben *et al*., 2018).

Clinical signs of sheep pox include fever, nasal and ocular discharge, anorexia, and depression. These signs are followed by the development of vesicles on the skin, mucous membranes, and internal organs. In severe cases, the respiratory and lymphatic systems may also be affected, leading to respiratory distress and lymphadenopathy (Mangana *et al*., 2008).

Diagnosis of sheep pox is based on clinical signs, virus isolation, serological tests, and polymerase chain reaction (PCR). Differential diagnosis should consider similar diseases, such as orf, LSD, and Pappilomatosis (Rao *et al*., 2000).

Treatment options for sheep pox include supportive care, such as anti-inflammatory drugs, and vaccination. However, vaccination is often difficult in many areas due to the unavailability of vaccines and inadequate knowledge of good vaccination practices (Garner *et al*., 2000).

Prevention and control measures should focus on the use of biosecurity measures, identification and culling of affected animals, and control of vectors (Barua *et al*., 2017).

Generally, sheep pox is a highly contagious and economically important disease of sheep. Hence, this case was undertaken to describe the clinical signs, treatment, and its outcome in sheep at Modjo veterinary clinic, Central Ethiopia.

3.4.6. 3. Case Description

A 3-year-old white brown colored ram was presented to the modjo veterinary clinic with a history of nodules on skin, depression, and inappetance for the past three days. The sheep was part of a flock of six sheep, and no other animals had shown similar symptoms. The sheep grazed grasses and had not been vaccinated or medicated against any diseases. The sheep had no history of environmental and diet change.

Up on physical examination, the sheep was found to be depressed and febrile with a rectal temperature of 39.2°C, had lameness on right hind limb and small raised nodules on the skin of the right cheek, left limb, and ventral part of the tail. In addition, the sheep had slightly increased heart (82) and respiratory rates (34 breaths/minute) with no other abnormalities detected. The sheep's body condition was good.

Based on history and clinical signs, pox was tentatively diagnosed and differential diagnosis including Lumpy skin disease, Dermatophilosis, orf, blue tongue, MCF, and Papillomatosis were listed. Due to a lack of viral transport media on that day, sample was not collected and the case was not confirmed by laboratory diagnosis.

a)

b)

Figure 22 Clinical signs of sheep pox, a) small nodules on tail b) nodules on cheek

3.4.6. 4. Case Management and Treatment Outcome

Since there is no specific treatment for pox disease, 20% Oxytetracycline was administered to prevent Secondary bacterial infections. The owner reported that the animal recovered and the skin lesions fully disappeared in a month. Considering the zoonotic importance of the disease, the owner was advised to take appropriate precautions when handling the sheep.

3.4.6. 5. Discussion

Pox disease is a viral disease that can affect various animals, including sheep. In this case report, a clinical signs, treatment and its outcome in 3-year-old ram was presented.

The clinical signs observed in this case report, including depression, skin nodules on cheek, limb, and tail and lameness on the hind limb, and are consistent with literature and reports on pox disease in sheep (Rao *et al*., 2000). However, reports by Afsah *et al*. (1986) had found additional signs of coughing, nasal discharge and lacrimation.

Moreover Cheek, limb, and tail were the areas affected by nodules in this case. However, in addition to these sites on the body, reports had reported the nodules in the skin around the eyes and nostrils (Garner *et al*., 2000; Mondal *et al*., 2004).

Differential diagnosis of the case, Lumpy skin disease, Dermatophilosis, orf, Papillomatosis were listed in this case. These diseases were considered due to the reason that they all cause skin lesions that look similar to pox disease.

LSD was ruled out because skin lesions seen in this case were typically small, raised, and scabby. LSD lesions in sheep are typically larger and more pronounced, usually firm, round, raised, and painful (Constable *et al*., 2017). Orf was ruled out as orf lesions have a characteristic thick scab, which is different from the small nodules seen in this case (Constable *et al*., 2017).

Dermatophilosis was ruled out because, unlike pox lesions, its lesions have scab-like crusts that stick to hair or wool overlying and are concentrated typically in wet areas like back, neck, and legs of an animal, another reason is that sheep pox causes fever and systemic symptoms while Dermatophilosis does not show fever or other systemic symptoms (Bhanuprakash *et al*., 2006). Papillomatosis was ruled out since it involve more delicate areas such as face, mouth, and

genitalia in comparison to sheep pox and the lesions of papillomatosis are typically smooth, cauliflower-shaped lumps, unlike the reddish nodules of sheep pox (Ben, 2021).

In this case, laboratory diagnosis was not performed due to a lack of viral transport media. This is a limitation of this case report, as confirmation of the diagnosis through laboratory tests, such as PCR or virus isolation, can be crucial for the appropriate management and prevention of the disease. EDDIE app diagnosed the case as sheep pox, indicating the match with tentative diagnosis made.

There is no specific treatment for pox disease in sheep, and treatment is generally supportive in nature. In this case, oxy 20% was administered to prevent secondary bacterial infections, which is a standard treatment protocol in other reports (Bhanuprakash *et al*., 2006). In addition, the owner was advised to isolate the affected animal from the flock and also take appropriate precautions when handling the sheep with pox disease, due to its zoonotic nature. This was in parallel with reports by (Fenne, 2017).

The sheep in this case was reported to have recovered fully from the skin lesions within a month after treatment.

This is in line with Barua *et al*. (2017), who reprted that sheep mostly recover from pox disease with in 3 to 4 weeks. However, this is not in line with Rather *et al*. (2020), who reprted the death of sheep affected with pox disease. This might be due to the difference in the severity of the disease and the immune status of the animal.

In conclusion, Sheep pox is an important viral disease of sheep. Appropriate diagnosis is important for differentiation from other similar diseases, and supportive treatment to manage secondary infections is be helpful. Animal handlers and farmers should vaccinate their animals to prevent the disease and take appropriate precautions when handling sheep with pox disease, due to its zoonotic nature.

3.4.6. 6. References

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3.5. Case Report on Caprine

3.5.1. Clinical Mastitis in doe

3.5.1.1. Abstract

Mastitis is a common disease amongst ruminants and is characterized by inflammation of the mammary gland. A case of a 30 kg adult doe with mastitis was presented to the Addis Ababa University, College of Veterinary Medicine and Agriculture, Professor Fisseha G/ab veterinary teaching hospital on October 19, 2020, with a history of a swollen udder, depression, and reduced feed and water intake. On physical examination, the doe was found to have fever, a swollen, painful, red, and hot udder, and increased heart and respiratory rates. Clinical signs and history led to the tentative diagnosis of mastitis, with differential diagnoses of mammary edema and udder abscess considered. The EDDIE smartphone application had a limitation in that it did not include mastitis in its list of cases. Milk samples were collected and sent to the veterinary bacteriology laboratory of CVMA for investigation. Results showed the growth of Gram-negative rod-shaped Escherichia coli *(E. coli*) bacteria. Management and treatment included an administration of 10% oxytetracycline and dexamethasone, with preventive measures and hygienic practices also followed. This case highlights the importance of early diagnosis and prompt treatment to prevent severe complications from mastitis. Laboratory investigation facilitated the confirmation of diagnosis by identifying the bacterium responsible for the infection. Effective preventive measures, including maintaining good hygiene practices in the pen, regular udder checks and avoiding overcrowding, are necessary to prevent the occurrence of mastitis. Veterinary professionals and farmers should also be aware of the risk of E. coli and the importance of hygiene in reducing its spread.

Key words: *Mastitis, Doe, Clinical Signs, Diagnosis, Escherichia Coli, Treatment*

3.5.1.2. Introduction

Mastitis is a common disease in goats that involves inflammation of the mammary tissue. It is a significant economic and health problem in goats worldwide, caused by either contagious or environmental pathogens. Contagious pathogens such as Staphylococcus aureus and Streptococcus agalactiae live on and in the does' mammary gland and are often transmitted from doe to lambs during the milking process. Environmental pathogens, on the other hand, reside in

the environment in which goats live, and examples include streptococci other than S. agalactiae and coliforms or Gram-negative bacteria (Mavrogianni *et al*., 2011).

There are several bacteria which are known to cause mastitis in sheep and goats including Streptococcus sp., Staphylococcus sp., Pasteurella sp., and coliforms, such as E. coli (Polveiro *et al.*, 2022).

Generally, mastitis is classified into clinical, sub-clinical, and chronic categories (Bergonier *et al.* 2003). Clinical mastitis is the term used for bacterial infections of the mammary gland that are present with obvious symptoms. Visible indications of clinical mastitis include swelling, redness or necrosis of one or more half udders and abnormal discharge of milk (presence of clots or serum), as well as other symptoms such as anorexia, fever or agalactia. Usually the consequence of clinical mastitis is toxaemia and gangrenous necrosis of the udder (Olechnowicz and Jackkowski, 2014).

Clinical Examination is an important part of mastitis diagnosis. Individual udder quarters are examined for abnormal type of size, consistency, symmetry, fibrosis, inflammation signs by thorough inspection & palpation. Milk is examined for the detection of abnormalities such as discoloration, blood ting, wateriness, clots, flakes & pus. In addition, bacterial culture of milk sample is the standard diagnostic method for goat mastitis (Sanchez *et al*., 2003).

The treatment and prevention of mastitis in goats involve various methods that aim to minimize the occurrence of the disease. These includes good husbandry practices, such as proper sanitation, maintaining a clean environment, regular udder cleaning, and regular maintenance of milking equipment (Mavrogianni *et al*., 2011).

Antibiotics are the primary method of treating bacterial mastitis in goats. It is important to identify the pathogen through culture and susceptibility testing to determine the most appropriate antibiotic therapy.

Intramammary infusion therapy involves inserting antibiotics directly into the teat canal to treat mastitis. Infected goats should be isolated to prevent the spread of infection to the rest of the flock (Menzies *et al*., 2001).

Vacines are also one of the method. Proper milking procedures to clean and disinfect the udder before and after milking can help prevent mastitis. Regular udder checks can help detect mastitis early and allow for prompt treatment. Proper nutrition is essential in preventing mastitis and promoting immune system function in goats (Contreras *et al*., 2007).

Generally, generally, mastitis is an important disease in goats, which has a significant economic and health problem. Hence, this case report was undertaken to describe the clinical signs, diagnosis, and treatment of mastitis case in doe presented to AAU-CVMA, Professor Fisseha G/ab VTH.

3.5.1.3. Case Description

A 30 kg adult doe was presented to veterinary teaching hospital of Addis Ababa University on October 19, 2020, with a history of swelling of udder, depression, and reduced feed and water intake. A doe had no history of illness, trauma, medication, or vaccination. It was kept extensively with a flock of 3 goat and 2 sheep, and fed on grass and leaves found in the area. Upon physical examination, a doe had depression, fever (38.8 ^{0C}), and swollen, painful, red, and hot udder, pale mucus membranes, increased heart (80 beat/min) and respiratory rate (28 breath/min). However, examination of other areas of the body and systems revealed no abnormalities.

The EDDIE smart phone app had not included mastitis in the list of cases. Based on the history and clinical signs observed the case was tentatively diagnosed as clinical mastitis and its differential diagnosis, mammary edema, and udder abscess were listed.

Figure 23 Clinical sign of mastitis in doe, swelling of the udder (arrows)

3.5.1.4. Laboratory Investigation and Findings

The milk sample was aseptically collected and immediately taken to veterinary bacteriology laboratory of CVMA. Then, the sample was enriched with tryptone soya broth and incubated at 37 ^{0}C for 24 hours. Then, a loop full of sample was streaked on the prepared Mannitol Salt Agar media and on McConkey agar, and incubated at 37 0c for 24 hours. After 24 hours of incubation, the colony of grown bacteria was observed on McConkey agar media, while there was no bacteria grown on MSA.

Then, the colony from the macConkey agar was sub cultured on nutrient agar medium and EMB (Figure). The gram's staining was performed from the pure colony on the nutrient agar. Gram stain result revealed gram-negative, rod-shaped bacterium, E. coli. Finally it was concluded based on the growth patterns and Gram‟s stain results that the bacterium responsible for the mastitis case was E.coli. Based on the history, clinical signs and laboratory finding the case was definitely diagnosed as mastitis caused by *E.coli bacteria*.

3.5.1.5. Case Management and Treatment Outcome

10% oxytetracycline (Shanghai Thongren Pharmaceutical Co. Ltd, China) at a dose rate of 10mg/kg, IV, for five days, and Dexamethasone (Sokar Healthcare Pvt Ltd, Gujarat, India) at a dose of 0.2 mg/kg per day, IM for three days were administered. In addition, the owner was advised to keep the animals' house hygiene to prevent transmission of the disease. On follow up, the doe's appetite improved after first day of treatment, and the swelling of the udder was reduced slowly. The doe fully recovered after two weeks of treatment, but one teat had become blind.

3.5.1.6. Discussion

Mastitis is an inflammation of the mammary gland, which is commonly caused by bacterial infections, such as *E. coli, Staphylococcus aureus, and Streptococcus agalactiae*. The disease has been reported from different parts of Ethiopia (*Megersa* et al., *2010).*

The case report describes the presentation, diagnosis, and treatment of a 30 kg adult doe with mastitis. The doe was presented with a history of swollen udder, depression and reduced feed and water intake. Upon physical examination, the doe was found to have a fever, pale mucus

membranes, an increased heart and respiratory rate, and a swollen, painful, red, and hot udder. Based on history and clinical signs, the case was tentatively diagnosed as clinical mastitis.

Clinical signs of mastitis in a doe include swelling, redness, and heat in the udder, reduced appetite and water intake, fever, and changes in the color and consistency of milk (Sanchez *et al*., 2003). In severe cases, the udder may also be painful to the touch, this was similar to clinical signs reported in this case report.

To confirm the diagnosis, a milk sample from the doe was collected and processed in bacteriology laboratory. The culture result revealed Gram-negative rod-shaped bacteria, *E. coli.*

This approach and result is in agreement with (Haftay *et al*., *2016).* The EDDIE smartphone application had a limitation in that it did not include mastitis in its list of cases. This indicates the need to improve the app inorder to diagnosis mastitis.

Treatment for the disease in this case involved the use of antibiotics (Oxytetracycline) and anti-inflammatory drug (Dexamethasone). In addition, the owner was also advised to maintain hygienic conditions in the animal's house to prevent transmission of the disease (Singh *et al*., 2018).

In conclusion, this case report emphasizes the importance of definitive diagnosis and appropriate medication to treat mastitis in doe. It also highlights the necessity of maintaining hygienic conditions in the animal's house to reduce the risk of infection.

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3.6. Case Reports On Poultry

3.6.1. Newcastle Disease Outbreak in Layer Chickens

3.6.1.1. Abstract

This case report describes an outbreak of Newcastle disease (NDV) in a flock of 3.5-week-old lowmans layer breed chickens on November 15, 2022 in Bishoftu town, Ethiopia. The flock consisted of 5000 birds raised on litter in a large scale intensive commercial poultry farm. The chickens showed clinical signs such as depression, decreased feed and water intake, abnormal movement, torticollis, circling, watery eyes, greenish diarrhea, and respiratory distress. The birds had a history of vaccination against Marek's disease, Newcastle disease virus, and Infectious bursal disease and had no history of environmental or feed change. Based on the clinical signs and history, NDV was tentatively diagnosed. Post-mortem examination confirmed hemorrhage in the trachea, proventriculus, and cecal tonsil. The conventional RT-PCR assay identified NDV in the collected samples, confirming the diagnosis. Oxytetracycline powder was given for five days to prevent secondary bacterial infections. The affected birds were isolated, and biosecurity measures were recommended to prevent further spread of the disease. The mortality rate continued for three days after treatment and then decreased by the fourth day, with the flock making a full recovery after a week. Owner were recommended to apply effective measures, such as vaccination and biosecurity measures to control and prevent outbreaks of NDV in poultry farm.

Key words: Newcastle disease, clinical signs, Post-mortem examination, RT-PCR, Oxytetracycline

3.6.1.2. Introduction

Newcastle disease (NCD) is one of the most important poultry disease inflicting enormous economic loss to the country, Ethiopia due to high morbidity and mortality (Alemneh, 2019). Newcastle Disease (ND) virus is a paramyxovirus in the genus Avulavirus that infects both domestic and wild free-ranging avian species(Wajid *et al*., 2017). It has a wide host-range of more than 250 domestic bird species including, Chickens, Turkeys, Pheasants, Guinea fowl, Muscovy, Ducks, Geese, and free-ranging wild birds including migratory waterfowl, shorebirds,

Passerines, and wild pheasants (Afonso *et al*., 2012).

The first cases of NCD were found in Java, Indonesia, and Newcastle-upon-Tyne, England in 1926. Since then epidemics of the disease are most commonly observed in Central and South America, Africa, and Asia (Alemneh, 2019). The disease first appeared on the African continent in the 1930s and the 1940s (Miguel *et al*., 2013). In Ethiopia, the first confirmed case of the disease was recorded in 1971, following the occurrence of an outbreak in Asmara city. Later, the disease gradually distributed all over the country through wild birds and other related risk factors (Sahlu, 2015). Although there is no recent report available, According to WAHID (2016), Ethiopia reported an average of 50 outbreaks per year in 2005–2015 to the World Organization for Animal Health.

There are 12 different avian paramyxovirus serotypes characterised, but NCD is limited to avian paramyxovirus serotype 1 (APMV-1). The virus is an enveloped, non-segmented, single-stranded, negative-sense RNA virus with a helical morphology containing 15kb nucleotides. The genome of the virus contains six open reading frames that encoding six major structural proteins: Nucleoprotein (N), phosphoprotein (P), matrix (M), fusion (F), hemagglutinin-neuraminidase (HN), and large polymerase (L). HN and F protein are the two major surface glycoproteins of the virus. The HN protein mediates the binding of the virus to host target cells whereas the F protein facilitates the fusion of the viral envelope with the cellular membrane of the target cells (Gogoi *et al*., 2017).

Virus isolation, either in specific pathogen free (SPF) chicken eggs or cell cultures and detection by RT-PCR followed by F gene sequencing are the definitive diagnostic assay for ND (OIE, 2021). The mean death time assay performed on SPF embryonating chicken eggs and the intracerebral pathogenicity test (ICPI) on day old chicken are the most commonly used assessment for virulence of NCDV (Miller *et al*., 2010).

Clinical signs of NCD are often easily confused with other poultry diseases (Ratih *et al*., 2017). This result in difficulty to clinically know the specific disease causing outbreak in poultry farms. Moreover, there is scarcity of case report on Necastle disease in poultry in Ethiopia. Therefore, this case report was undertaken with the aim of describing the clinical signs, diagnosis, and treatment of Newcastle disease virus in one poultry farm in Bishoftu town.

3.6.1.3. *Case description*

Three and half weeks old lowmans layer breed chicken with a history of depression, decreased feed and water intake, and abnormal movement(circling) for the past two days were examined on a farm located at Chukala (zukala) area, Bishoftu town, on November 15, 2022. The farm has a flock of 5000 birds of the same age raised on litter in a big scale intensive commerical poultry farm. The attending veterinarian said that there were an outbreak of the disease since last week and mortality of 400 chickens (about 50 mortality per day) were recorded from the same condition. On the day of examination, mortality of 30 chickens and 54 morbidity (diseased) were recorded.

The chickens were fed commercial starter diet, and the water source was tap water. They were vaccinated against Marek's disease at a hatchery, Newcastle disease virus on third day of arrival, and Infectious bursal disease (IBD) on 18^{th} day. The flock had a history of enroflaxclin (on first week of arrival), vitamins, and amprolium medication. There were no history of environmental and feed change. Up on physical examination, there were nervous signs (torticollis and circling), watery eyes, greenish diarrhea, and respiratory distress were recognized. The chickens had no external parasite and had average temperature 41 ^{o}c.

Based on the history and clinical signs, the case was tentatively diagnosed as Newcastle disease, and potential differential diagnosis, such as mareks disease, gumburo, infectious bronchitis, and infectious laryngotracheitis were listed.

3.6.1.4. ***Laboratory investigation and findings***

To confirm the case, based on owner's request, three severely affected chickens were taken to post mortem facility of the National Veterinary Institute (NVI), Bishoftu, Ethiopia. The chickens were killed by cervical dislocation and standard post-mortem examination was conducted to identify the necropsy findings and collect aseptically the required pathological samples for the study. Samples from lungs, intestine, spleen, caecal tonsils, brain, liver and heart were aseptically collected based on the clinical signs and post mortem findings seen in each chickens.

The collected samples were placed in sterile isotonic phosphate buffered saline (PBS), pH 7.0–7.4 with antibiotics (penicillin 2000 units/ml); streptomycin (2 mg/ml) and gentamycin (50 µg/ml). The samples were immediately transferred to virology laboratory of the institute and kept at -18°C until processed (OIE, 2018).

On the following day, the samples were taken out of the refiregerator, thawed at room temperature and processed for virus isolation as indicated in the manual of the World Organization for Animal Health (OIE, 2018). About 1gram of pooled samples were cut into small pieces using sterile scissors and grinded by mortar and pestle under sterile class II biosafety cabinet. 10% w/v tissue suspensions were prepared by adding 9ml of PBS containing antibiotics and antifungal. The suspension was transferred to 10 ml glass test tube and the supernatant fluids obtained through clarification by centrifugation at 1000xg for about 10 minutes at +4°C. One ml of supernatant fluid was harvested and aliquoted into sterile cryovial tube for use in detection of the virus (OIE, 2018).

The samples were detected by the conventional reverse transcription polymerase chain reaction (RT-PCR) test at the molecular biology laboratory of NVI, Bishoftu, Ethiopia. The RNA was extracted from tissue suspension using the RNeasy® Mini kit (Qiagen, Hilden, Germany) according to manufacturer's instruction (Appendix II). Master Mix was prepared using the Qiagen One-Step RT-PCR kit (Appendix III). RT-PCR reaction mixture of each sample consisted of 5µl of RNase free water, 5 µl of kit-supplied buffer (5×), 5µl of kit supplied Q-solution, 2µl of forward Primer M610-5′-CTGTACAATCTTGCGCTCAATGTC-3′ (5pM), 2µl of reverse primer NCDVF-581-5′-CTGCCACTGCTAAGTTGTGATAATCC-3 ′(5pM) Eurofins Genomics, Austria), 1µl of kit-supplied enzyme mix, 1µl of kit-supplied deoxynucleoside triphosphates (10mM), and 5µl of the sample (RNA), resulting in a final reaction volume of 26µL. The amplification was done by a thermal cycler (2720, Applied BioSystems, USA) with PCR protocol of cDNA synthesis at 50°C for 30 minutes, an initial denaturation at 95°C for 15minutes, followed by 35 cycles of denaturation at 94°C, annealing at 53°C and extension at 72°C each for 30sec, and final extension at 72°C for 10 minutes.

The amplified PCR products were analysed with 1.5% agarose gel (Cleaver scientific Ltd, UK, Lot no: 14160704) and the gel was stained with 5µl of an intercalating dye (20x Pronasafe, Condalab® Canada, lot no: 210203). Briefly, 10µl of each PCR products mixed with 5µl of 5X gel loading dye (Hi Media®, India) and loaded into separate well. Six µl of Gel Pilot® DNA molecular marker starting at 100bp (Qiagen, Germany, Lot no: 25.1) was run simultaneously in first and last well to estimate the size of the sample PCR product at 120v electric current for 1 hour on an electrophoresis apparatus (EC 2060, USA). Illumination with ultraviolet light (UVI TEC, UK) was used to visualize stained DNA. A positive result for NCDV showed a band size of around 1100bp (Figure 26).

Accordingly, on post mortem examination, hemorrhage were found in the trachea, proventriculus, and cecal tonsil. The conventional RT-PCR assay result revealed presence of NDV in all the three samples at an amplicon of 1100 bp. The findings revealed the chicken were suffering from NDV outbreak.

a **b**

Figure 24 Clinical signs of NCD in examined chicken, Torticolis (a), greenish diarrhea (b)

a b c

Figure 25 Post-mortem findings of chickens diseased with NCD virus: A: hemorrhage in trachea,b: pin point hemorrhage in proventriculus C: hemorrhage in cecal tonsil

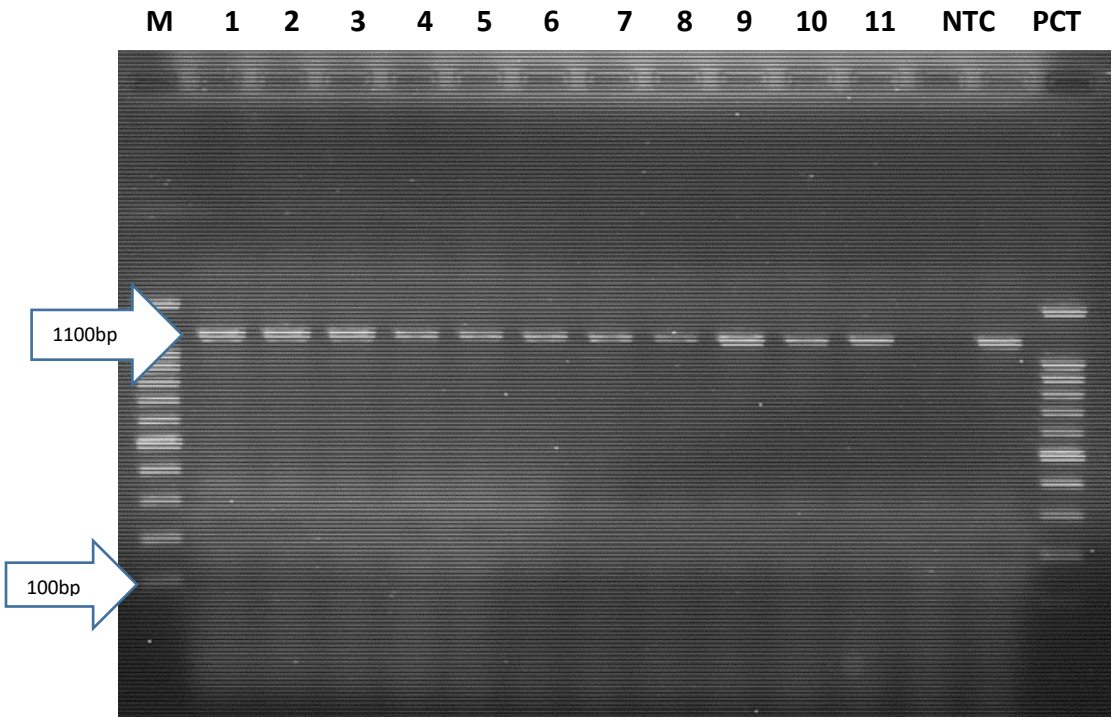

Figure 26 Conventional RT-PCR based detection of NCD virus. Lane M: 100 bp plus molecular ladder (HiMedia), Lane NTC: negative template control, Lanes 1, 2, 3: positive samples of this case report. Lane 4-11, positive samples from NVI.

3.6.1.5. Case management and treatment outcome

Since there is no specific treatment for NCDV, Oxytetracycline, 1% powder (5 g per 4.5 litres of drinking water for diseased ones, 2.5 g per 4.5 litres of drinking water for the exposed flock) was adminstered for 5 days to prevent secondary bacterial infection. Besides the treatment, the attendant was advised to isolate the disease ones, and keep biosecurity of the farm to prevent spread of the virus. After the treatment, mortality was continued for three days, but started decreasing on 4th day, then the flock completely survived after a week.

3.6.1.6. Discussion

Newcastle disease is one of the most prevalent diseases of poultry in Ethiopia. The disease is endemic in Ethiopia since its first appearance in 1971 and is continuously posing economical threat to the poultry sector (Tadelle and Jobre, 2004). Outbreaks of the disease in commercial chicken flocks have been increasingly reported in the country.

This case report described the clinical signs, diagnosis, and treatment of outbreak of Newcastle disease in a flock of 5000, three and a half weeks old lowmans layer breed chickens. The affected chickens were showing signs of depression, decreased feed and water intake, and abnormal movements such as circling. Additionally, nervous signs (torticollis and circling), watery eyes, greenish diarrhea, and respiratory problems were observed during physical examination. The case of this outbreak were confirmed as NCDV.

Diagnosis of the disease in this case involved the history, clinical signs, post-mortem, and molecular detection by PCR. This is in agreement with Worku *et al*. (2022)

Clinical signs of NDV such as torticollis, circling, ocular discharge, ruffled feathers, respiratory distress, and greenish diarrhea were recorded in this cases. This was in agreement with the results of previous studies by (Bereket *et al*., 2017) in Eritrea and (Khorajiya *et al*., 2015) in India.

Gross pathological lesions observed in most of the chicken were typically of NCD. The lesions were characterized by pin point haemorrhages in proventriculus, diffuse haemorrhage in caecal tonsils and trachea. This is in agreement with the reports of (Khorajiya *et al*., 2015; Worku *et al*., 2022).

In conclusion, this case report highlights the clinical signs, diagnosis, and treatment and control of NCDV outbreak in poultry farms. Early intervention, along with strict biosecurity, can help prevent disease spread and minimize economic losses associated with disease outbreaks in poultry farms.

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3.6.2. Ileal Obstruction in a Layer Chicken

3.6.2.1. Abstract

Gastrointestinal (GI) obstruction in chickens refers to a blockage that prevents food or liquid from passing through their digestive system. Ileum is the end part of small intestine, and it is a common area of gastro-intestinal obstruction. Ileal obstruction is a rare condition in chickens that can have multiple etiologies, including torsion, volvulus, intussusception, and obstruction due to foreign bodies or tumors. This case report describes a 5-month-old lowmann breed layer chickenbrought to Addis Ababa University, Professor Fiseha G/ab veterinary teaching Hospital on December 20, 2022, with lethargy, decreased weight gain, and anorexia for three weeks. Based on clinical signs, it was diagnosed with gastrointestinal obstruction, and a necropsy was performed to confirm the disease. The findings indicated ileal obstruction caused by a foreign body (litter). The owner was advised to monitor the flock for any similar health issues and maintain good management practices to prevent the occurrence of the condition. Since the chicken was necropsied, there was no treatment given. Meanwhile, the owner reported no similar cases occurred in the farm after one month.This case report highlights the importance of diagnosis, and prevention of ileal obstruction caused by foreign bodies in chickens.

Keywords*:* *Ileal Obstruction, Clinical Signs, Necropsy, Foreign Body*

3.6.2. 2. Introduction

Gastrointestinal (GI) obstruction in chickens refers to a blockage that prevents food or liquid from passing through their digestive system. These obstructions can be classified as either extra-luminal or intra-luminal. Extra-luminal obstructions include tumors and hernias, which can impede the passage of feces in birds. Intra-luminal causes can result from the ingestion of foreign bodies such as string, baling twine, bedding litter, Styrofoam, plastics, artificial grass, etc., the formation of bezoars, buildup of roundworms, and sloughed koilin (Ramesh *et al*., 2021).

GI obstructions can occur at any point along the chicken's digestive tract. The chicken's digestive system has several key anatomical differences from mammals, partly due to the fact that birds lack teeth for the mechanical breakdown of food. Instead, mechanical breakdown occurs within the digestive system. The chicken's digestive tract comprises the esophagus, crop, proventriculus (also known as the glandular stomach), ventriculus (also known as the gizzard), small intestine (including the Duodenum, Jejunum, and Ileum), ceca, large intestine, and cloaca. The small intestine is one of the common sites of GIT obstruction in chickens (Pradeep and Reddy, 2019).

Ileal obstruction is a rare condition in chickens that can have multiple etiologies, including torsion, volvulus, intussusception, and obstruction due to foreign bodies or tumors. These foreign bodies can include feed material like plastic feed bags, twine, and small pieces of stones, as well as other debris that chickens may ingest in the aviary. Intussusception, twisting, and volvulus of the ileum due to adhesions or other anomalies can also cause ileal obstruction (Rajkhowa *et al*., 2019).

In addition to foreign body obstruction, inflammation of the intestinal mucosa, resulting from viral, bacterial, or parasitic infection, can lead to intestinal stricture and partial obstructions. Although rare, ileal obstruction in chickens can cause significant morbidity and mortality, particularly if not promptly identified and treated (Huang *et al*., 2019).

Chickens with ileal obstruction typically present with clinical signs such as abdominal distension, lethargy, decreased appetite, and fecal impaction. Diagnosis often requires a combination of clinical examination, imaging studies, and surgical exploration or necropsy examinations in the cases. Treatment options may include surgical intervention, dietary and management changes, or supportive therapy. Overall, ileal obstruction is a potentially serious

condition in chickens that requires prompt management to prevent significant morbidity and mortality (Maria *et al*., 2017).

Ileal obstruction can be difficult to diagnose clinically, and failure to recognize and treat it promptly can lead to severe complications, such as sepsis, intestinal rupture, and death (Kaboudi *et al*., 2015).

Although rare, ileal obstruction has been reported in literature. However, there are very few reports on this condition, and there is no previous report on ileal obstruction in chickens in Ethiopia. Therefore, this case study was conducted to describe the clinical signs and post-mortem findings of ileal obstruction in a layer chicken presented to AAU-CVMA, Professor Fiseha G/ab VTH.

3.6.2. 3. Case description

On December 20, 2022, a 5-month-old lowmann breed layer chicken was brought to AAU-CVMA-veterinary teaching hospital with a history of anorexia (for the past three days), lethargy, and decreased weight gain for the past three weeks. The chicken was part of a flock of 500 birds raised on litter in a small scale intensive farm. Among three chikhens that had shown a sign of disease in that week, it was the only one that hadn't responded to the medication (enrofloxaclin) administered by the owner. It was fed on commercial pellet diet, and the water source was tap water. According to the owner, the flock was vaccinated more than three times since its first day arrival, but couldn't rememeber the type of vaccines.

On physical examination, the chicken was lethargic, emaciated, and had pale comb and wattle. The crop was full with feed. The cloaca was clean and free of fecal material. The rectal temperature was in normal range (40.5 ^{o}c) and no external parasite found. Based on the history and clinical signs, the case was tentatively diagnosed as gastrointestinal obstruction and the owner was communicated about the case and its prognosis. After the communication, the owner requested a necropsy to be performed on the chicken to confirm the disease.

3.6.2. 4. Laboratoty Investigations and findings

Post mortem examination was perfomed to diagnose the case. The carcass was systematically opened and the findings were recorded. The findings revealed an enlongated foreign body mass

(litter) in the distal portion of Ileum. Cecum were dried and misshaped, the part of intestine above intussusception was swollen as indicated in (Figure 27b). Finally, the case was diagnosed with ileal obstruction caused by foreign body (litter). The owner was informed of the findings and was advised to monitor the remaining flock for any signs of similar health issues, and review his management practices, including nutrition and hygiene, to prevent the occurrence of similar cases.

a)

b)

Figure 27 a) obstruction at Ileum (arrow), b) hardened foreign body (litter) in ileum

3.6.2. 5. Case management and outcome

Since the chicken was necropsied, there were no treatment given to the chicken. However, the owner was advised to maintain good management practices to prevent the occurrence of the condition for the rest of flock. A month after this, the owner said that, there were no similar cases happened in his farm.

3.6.2. 6. Discussion

Ileal obstruction is a rare occurrence in chickens and is due to various causes, including mechanical obstructions caused by foreign bodies, volvulus, torsion, intussusception, or neoplastic masses. Foreign body ingestion leading to ileal obstruction is less common in poultry

production but can originate from a variety of items, including small stones, feed material (including plastic feed bags, twine, or wire ties), or other debris within the aviary or run.

In this case report, a 5-month-old lowmann breed layer chicken was brought to AAU-CVMA-veterinary teaching hospital with a history of anorexia (for the past three days), lethargy, and decreased weight gain for the past three weeks.

On physical examination, the chicken was lethargic, emaciated, and had pale comb and wattle. The crop was full with feed. The cloaca was clean and free of fecal material. The rectal temperature was in normal range (40.5 oc) and no external parasite found. These clinical signs are in line with Roza *et al*. (2006), and Schlegel *et al*. (2015).

Based on the history and clinical signs, the case was tentatively diagnosed as gastrointestinal obstruction and post mortem examination showed the case as ileal impaction due to ileal obstruction. This finding is similar to that of Schlegel *et al*. (2015).

In this case, definitive diagnosis was confirmed by post mortem examination. This is in line with reports Roza *et al*. (2006). However some reports have diagnosed ileal obstruction by diagnostic aid equipment like X ray and CT scan (Speer, 2015).

In conclusion, this case report highlights the importance of diagnosis, and appropriate management of ileal obstruction caused by foreign bodies in chickens. The role of good management practices in the prevention of such conditions is critical, and poultry producers should receive training on best practice guidelines for optimal management and maintenance of aviaries or runs. Early intervention serves as a critical factor in the management of ileal obstruction by foreign bodies in chickens and can significantly improve the patient outcome.

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3.6.3. Coccidiosis in Chicken

3.6.3.1. Abstract

Coccidiosis is a common disease in poultry resulting in mortality, weight loss, and decreased production. This case report presents a successful treatment of coccidiosis in ten of three weeks old sasso breed chickens. The chickens presented on February 5, 2023 with depression, bloody diarrhea, and decreased feed and water intake. Tentative diagnosis of coccidiosis was made after physical examination, and the diagnosis was confirmed by fecal examination (floatation technique) and post mortem examination of one of the dead chickens. The affected chickens were treated with toltrazuril and prophylaxis was given to the rest of the flock with amprolium HCl, along with hygiene management practices. The diseased chickens recovered, and the whole flock showed normal health conditions after five days. Successful management of coccidiosis involves prompt diagnosis, appropriate treatment, and proper hygiene practices.

Key words: Coccidiosis, Treatment, Diagnosis, Floatation Technique, Post Mortem Examination

3.6.3.2. Introduction

Coccidiosis is a common and economically important parasitic disease that affects poultry, including chickens, turkeys, and game birds. It is caused by several species of the protozoan parasite in the genus Eimeria, which infect and destroy the host's intestinal cells, leading to weight loss, reduced growth rate, and increased susceptibility to other infections (Adene and Oluleye, 2004).

Transmission of the coccidia oocysts can occur directly through fecal contamination or indirectly through infected litter, feed, or water. The incubation period can range from 4 to 7 days, and clinical signs typically appear after the incubation period (Awais *et al*., 2012).

Clinical signs of coccidiosis in poultry vary depending on the severity of the infection and the age of the birds. Young birds are more susceptible and often show diarrhea, lethargy, and loss of appetite. Older birds may not show obvious signs, but they may have reduced egg production and growth rate (Dakpogan *et al*., 2013).

Diagnosis of coccidiosis is based on the clinical signs, microscopic examination of the feces for the presence of oocysts, and necropsy findings. Differential diagnosis should consider other poultry diseases, such as avian influenza, Newcastle disease, and infectious bronchitis (Haug *et al*., 2008).

Prevention and control measures for coccidiosis in poultry include good management practices, such as hygiene management, proper nutrition, and the use of coccidiostats in the feed or water. The coccidiostats can either be added to the feed or water, given prophylactically or therapeutically. Vaccination is also an effective measure to control coccidiosis, and there are several commercial vaccines available. Hence, this report was undertaken to describe the clinical signs and treatment of coccidiosis in chicken examined at a poultry farm in Bishoftu town (Taylor

et al., 2007).

3.6.3.3. Case Description

Ten three weeks old sasso breed dual purpose chicken with a history of depression, bloody diarrhea, and decreased feed and water intake for the past two days were examined on farm

located at Babogaya area, Bishoftu town, on February 5, 2023. The owner said that there were mortality of 3 other chickens in the farm on that day.

The chickens were part of a flock of 800 birds raised on litter in a small scale intensive farm. The chickens were fed commercial starter diet, and the water source was tap water. They were vaccinated against Newcastle disease virus on second day of arrival and Infectious bursal disease (IBD) on 17th day. The flock had no history of medication, and environmental and diet change.

Up on physical examination, the chickens were depressed, had ruffled feather, and watery diarrhea. The rectal temperature was in normal limits (39.8^{o}c) and no external parasite observed. Based on the history and clinical signs, the case was tentatively diagnosed as coccidiosis.

3.6.3.4. Laboratroty Investigations and Findings

To confirm the case, feces were collected from three of the diseased chicken and processed at veterinary parasitology laboratory of CVMA. In addition, postmortem examination was conducted on one of the chicken that died on that date. The fecal examination was conducted using simple floatation technique and Eimeria oocysts were detected in two of the three collected feces. In addition, post mortem examination revealed swollen and extensive haemorrhage (accumulation of of blood in caecum) (Figure 28b). Based on laboratory findings, the case was confirmed as coccidiosis.

3.6.3.5. Case Management and Treatment Outcome

Toltrazuril at 7 mg/kg per day for two consecutive days was administered orally in the drinking water for ten of the diseased chicken separately and amprolium HCl at 100 – 150 g per 100 litres of drinking water for five days was used as prophylaxis for the rest of the flock. Besides the drug treatment, the owner was advised to clean and change litter and keep hgiene of the poultry house. Two days after the treatment, the owner reported that two chickens were died while the rest had improved signs of feed and water intake. The diseased chickens were recovered and the whole flock was in normal health condition after five days.

a b

Figure 28 a) diseases chicken b) Swollen and extensive haemorrhagic in caecum (accumulated clotted blood in the caeca)

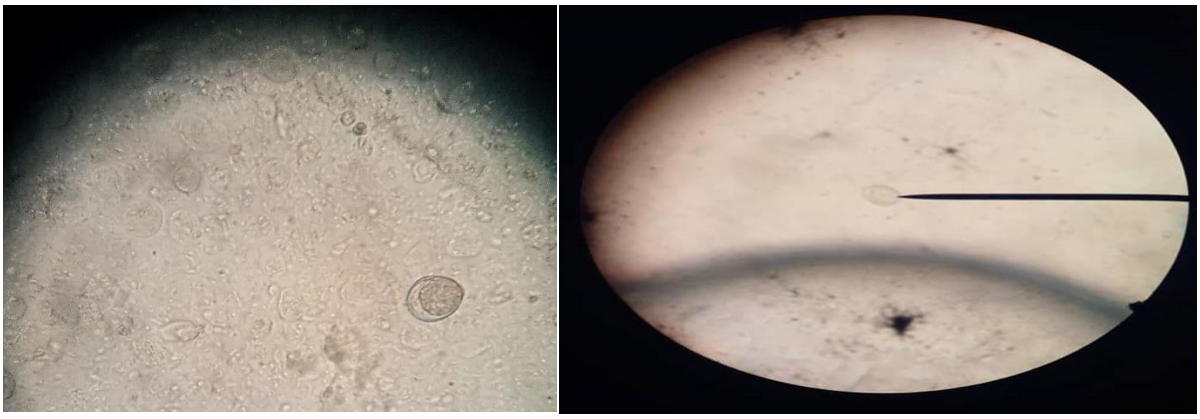

Figure 29 *Eimeria* oocyst seen under the microscope (400x)

3.6.3.6. *Discussion*

This case report highlights a case of coccidiosis in a flock of sasso breed dual-purpose chickens, which presented with clinical signs of depression, ruffled feathers, and bloody diarrhea. The history of mortality and laboratory findings confirmed the diagnosis of coccidiosis, which is a consistent with other case reports on coccidisosis in chicken (.Ayaz et *al*., 2003; Dakpogan *et al*., 2013).

The results of the treatment of the diseased chickens suggest a successful outcome, with the majority of the flock exhibiting improved clinical signs, except for two chickens that died. The report emphasizes the importance of using and administering appropriate drugs for diagnosis and

treatment of coccidiosis, as well as good management practices such as hygiene and litter management to control the spread of the disease (Jadhav *et al*., 2011).

In conclusion, this case report adds to the growing evidence base that coccidiosis is a primary cause of morbidity and mortality among chickens, with significant economic consequences to the poultry industry globally. The study highlights the importance of early diagnosis using proper laboratory techniques and administering appropriate drug treatment. Good management practices, including hygiene and litter management, are also essential for controlling the spread of the disease.

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3.6.4. Fowl pox in Chicken

3.6.4.1. Abstract

Fowl pox is a viral infection in birds caused by a poxvirus that spreads through direct contact with infected birds, biting insects, contaminated fomites, and dust. This case report describes a 4-month-old Sasso pullet that was brought to the Modjo Veterinary Clinic on February 6, 2021, with a history of decreased feed and water intake, depression, and cutaneous, scabby lesions on the face. The chicken was part of a flock of 30 semi-intensive raised birds of the same age, and it was the only bird affected. There was no history of vaccination or medication for the bird, and a diagnosis of Fowl pox was tentatively made based on physical examination. A lack of viral transport media on that day prevented the confirmation of the diagnosis by laboratory testing. Since there is no specific treatment for Fowl pox in chickens, administration of 1% Oxytetracycline powder (was provided for three days to prevent secondary bacterial infections. The bird's scab was cleaned using iodine tincture and alcohol, and the owner was advised to isolate the chicken and take appropriate precautions due to the zoonotic nature of the disease. The chick made a full recovery, and the skin lesions completely disappeared after three weeks. In general, Poulty farmers should take necessary measures to prevent and manage the occurrence of Fowl pox in a flock.

Key words: *Fowl Pox, Diagnosis, Treatment, Physical Examination, Modjo*

3.6.4.2. Introduction

Fowl pox is a common viral disease that affects domestic and wild birds worldwide. It is caused by a poxvirus that spreads through direct contact with infected birds, biting insects, contaminated fomites, and dust (Alehegn *et al*., 2014).

Fowlpox affects both commercially and backyard-raised chickens. The disease is seen in all breeds and age groups of chickens and can occur throughout the year. Fowlpox is found worldwide, primarily in regions with a significant poultry population (Hess *et al*., 2011).

Factors that influence the disease's spread include bird density, overcrowding, poor sanitation, and environmental factors such as dust and vectors (Asfaw *et al*., 2021).

Fowl pox in chickens manifests through two forms: Dry form or Cutaneous pox and Wet form or Diphtheritic pox. The Cutaneous pox appears as small pus filled-tumors on the unfeathered areas of the chicken such as the comb, wattle, and face. The tumors eventually break, forming scabs, and can fall off. The diphtheritic form appears as yellow-gray lesions in the oral cavity, pharynx, and respiratory tract. When the Fowl pox virus enters the chicken's body, it first infects the skin and mucous membranes. The virus then spreads to the lymph nodes, replicating there before spreading to other organs. The virus replicates over several days, leading to a visible tumor on the skin or mucous membranes (Hartati *et al*., 2021).

The diagnosis of Fowl pox in chickens is based on the history of the disease and clinical examination. Laboratory tests such as virus isolation, serology, PCR, and electron microscopy can detect the virus's presence within the tissue or blood (Senties *et al*., 2010).

There is no specific antiviral treatment for Fowl pox in chickens. Isolation of the affected birds and supportive care, including providing nutritious feed and clean water, can aid in recovery. The scabs and lesions can be treated with topical ointments and antibiotics to prevent secondary bacterial infections (Lal *et al*., 2022).

Preventive measures are among the best strategies for Fowl pox control. Vaccination with live or inactivated virus vaccines is the most effective method of prevention as it confers long-term protection. Biosecurity also plays a role in preventing Fowl pox outbreaks, such as proper disinfection of pens between flocks and preventing contact with infected birds (El-Kenawy *et al*., 2005).

Generally, Fowl pox is an important viral disease of poultry in Ethiopia. Hence, this case report was undertaken to describe the occurrence, clinical signs, diagnosis, and treatment of fowl pox in chicken presented to Modjo veterinary clinic.

3.6.4.3. Case Description

On February 6, 2021, Four months old Sasso pullet was brought to the modjo veterinary clinic with a history of decreased feed and water intake, depression and cutaneous, scabby lesions on face (for four days). A chick is part of a flock of 30 birds of the same age raised semi-intensively, and fed mostly commercial feed and kitchen scraps. It is the only chick affected from the flock.

The owner said that he received the chick with its flock from his relative a month ago, and he didn't have knowledge of vaccination and mediciation history of the chick. In a month, there were no history of housing and feed change. Up on physical examination, the chick was depressed, had poor body condition and weight, and also had raised dry crusty scabs around nose and lip. The chick had no external parasite and had a temperature 41 ^{o}c. However, other system appeared normal. Based on the history and clinical signs, the case was tentatively diagnosed as Fowl Pox. Due to a lack of viral transport media on that day, sample was not collected and the case was not confirmed by laboratory diagnosis.

Fi**gure 30** Clinical sign of fowl pox in chicken

3.6.4.4. Case Management and Treatment Outcome

Since there is no specific treatment for pox disease in chicken, 1 % Oxytetracycline powder (5 g per 4.5 litres of drinking water) was administered for three days to prevent Secondary bacterial infections. In addition, the scab was cleaned by iodine tincture and alcohol.

Besides the treatment, the owner was advised to isolate the chick. Considering the zoonotic importance of the disease, the owner was advised to take appropriate precautions when handling the chick. The owner reported that the chick recovered and the skin lesions fully disappeared in three weeks.

3.6.4.5. Discussion

Fowl pox is a viral disease that affects poultry, including chickens, turkeys, and quails. In this case report, a clinical signs, treatment and outcome of fowl pox in 4-months-old chick was presented.

The clinical signs observed in this case report, including depression, poor body condition and weight, and also raised dry crusty scabs around nose and lip, are consistent with literature and reports on fowl pox disease in chicken (Senties *et al*., 2010).

In this case, laboratory diagnosis was not performed due to a lack of viral transport media. This is a limitation of this case report, as confirmation of the diagnosis through laboratory tests, such as PCR or virus isolation, can be crucial for the appropriate management and prevention of the disease (Hartati *et al*., 2021).

There is no specific treatment for fowl pox disease, and treatment is generally supportive in nature. In this case, 1% oxytetracycline powder was administered to prevent secondary bacterial infections. This is in agreement other reports (El-Kenawy *et al*., 2005). In addition, the owner was advised to isolate the affected chick from the flock and also take appropriate precautions when handling the chick with fowl pox disease, due to its zoonotic nature. This was in parallel with reports by Lal *et al*. (2022).

The chick in this case was reported to have recovered fully from the lesions within three weeks after treatment. This is in line with Hess *et al*. (2011), who reprted that chickens mostly recover from fowl pox disease with in few weeks.

In conclusion, fowl pox is an important viral disease of chicken. Appropriate diagnosis, and supportive treatment to manage secondary infections is be helpful. Animal handlers and farmers should vaccinate their animals to prevent the disease and take appropriate precautions when handling chicken with fowl pox disease, due to its zoonotic importance.

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4. OVER ALL RESULTS AND DESCRIPTION

In the study, 20 cases from various species were reported. Among the species, Cattle accounted for 35% (7/20) of the reported cases, sheep for 30% (6/20), goats for 5% (1/20), horses for 5% (1/20), chicken for 15% (3/20), and dogs for 10% (2/20)(Figure 31).

In terms of etiology, tentative and laboratory diagnoses revealed that viruses caused 25% (5/20) of the diseases, bacteria 25% (5/20), parasites 25% (5/20), metabolic disorders 10% (2/20), unknown causes 10% (2/20), and foreign bodies 5% (1/20).

In terms of treatment outcome, Out of the 20 cases reported, 15 (75%) recovered, 2 (10%) died, and 2 (10%) underwent post-mortem examination.

In terms of app accuracy, EDDIE app diagnosed 15 cases (7 cattle, 6 sheep, 1 goat, and 1 horse) but doesn't support poultry and canine diseases. The app correctly matched a confirmatory diagnoses in 8 cases, relatively matched in 2 cases, mismatched in 2 cases, and couldn't diagnose 3 cases (disease not registered on the app).

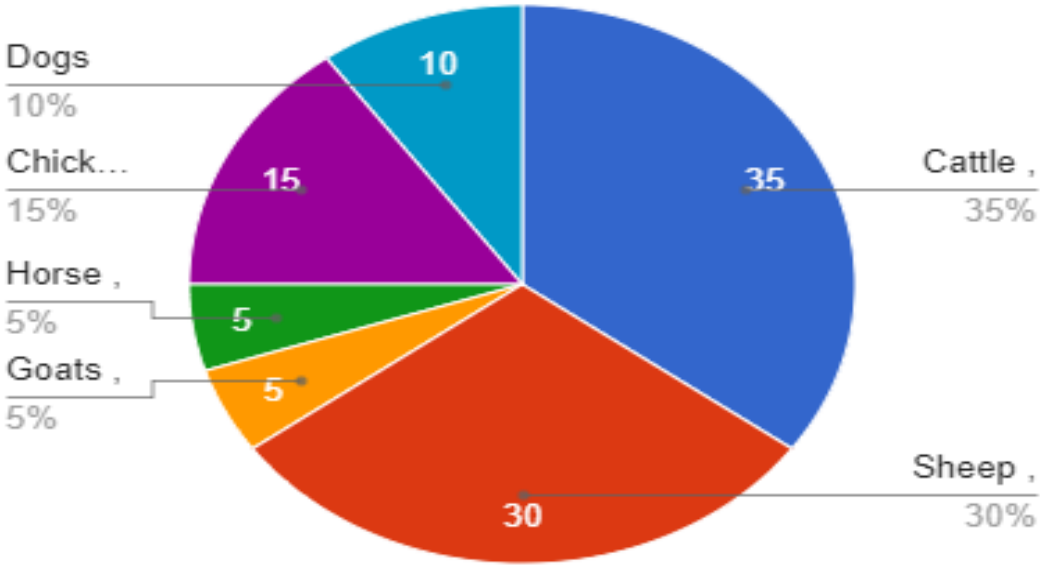


Figure 31 Reported Cases from various species

5. CONCLUSION AND RECOMMENDATIONS

The livestock sector plays a critical role in the Ethiopian economy, but animal diseases continue to limit its development, leading to significant economic losses and reduced productivity. The study aimed to report cases of disease in animals presented to animal health facilities in Bishoftu and Modjo towns between October 2020 to March 2021 and November 2022 to May 2023, and evaluate the EDDIE app as a veterinary diagnostic aid tool. Central Ethiopia, particularly Bishoftu and Modjo towns, are one of the areas affected by animal diseases, as confirmed by this study. In the study, 20 animal disease case reports were reported and revealed that viruses, bacteria, and parasites are the common causes of the disease in cattle, sheep, goats, horses, chickens, and dogs in study area. The study's findings on treatment outcome indicate that 75% of the reported cases recovered, 10% died, and 10% underwent post-mortem examination. This suggests that early diagnosis and appropriate treatment can significantly improve the chances of recovery for animals affected by various diseases. The EDDIE app aided in diagnosing some of these cases, but its coverage needs to be expanded to include more animal species and improve its accuracy in diagnosing diseases. The results of this study provide valuable insight into animal diseases and their proper diagnosis, treatment, and management practices in ensuring their health, and efficacy of the EDDIE app as a diagnostic aid tool.

Therefore, based on the above conclusion, the following recommendations are forwarded:

- Appropriate measures, including awareness creation, vaccination programs, biosecurity measures, and improved animal husbandry practices, should be put in place to help prevent and control animal diseases in the study area and beyond.
- Further research and development of the EDDIE app should continue to improve its accuracy in diagnosing diseases and expand its coverage to more animal species, including poultry and canine diseases.
- Further research should be conducted to identify more effective treatment options for different types of diseases.
- Veterinary practitioners should consider the use of suitable diagnostic aids such as EDDIE to help diagnose animal diseases.

6. ANNEXES

Annex 1 Clinical case recording form

ADDIS ABABA UNIVERSITY
COLLEGE OF VETERINARY MEDICINE AND AGRICULTURE

Daily Clinical Activity Recording Form
Date: ----------
Site/Name of the clinic: _____ Address: _____
Owner‟s name: _____ Address: _____ Phone number: _____
Patient identification: _____
Species: _____ Breed: _____ Sex_____ age: _____Color:_____
History:
Past immediate: _____Immediate history: _____
environment: _____ management and feeding:_____ :
Number of affected, no, at risk:_____ place of origin etc:_____
General physical examination: temperature: _____ heart rate: _____ respiratory rate:_____ , visible mucous membrane etc
Systemic physical examination: detailed examination of the affected system
Laboratory diagnosis methods employed_____ Tentative and definitive diagnosis_____, prognosis_____
Treatment: drug_____, dose_____, route_____, follow-up_____
Control & prevention: control methods prescribed, prevention and corrective management
Measures recommended_____

Annex 2 Clinical Examination Protocols, adapted from Jana and Ghosh (2013)

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.

Animal	**0C+/- 0.50C**
Horse	38
Cow	38.5
Sheep	39.5
Goat	39
Pig	39
Dog	39
Cat	38.5
Rabbit	39.3

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, toxaemia, circulatory failure, excitement and in pain striken 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 in a Horse is 28-45 beats per minute.
* Normal pulse rate in a Dog is 80–120 beats per minute.
* Normal pulse rate in a Cow is 55–100 beats per minute.
* Normal pulse rate in a Sheep/Goat is 60-110 beats per minute.
* Normal pulse rate in a Rabbit is 20–150 beats per minute.
* Normal pulse rate in a Cat is 100–140 beats per minute.
* Normal pulse rate in a Swine is 60-120 beats per minute

Recording of Respiration Rate

In cattle average respiration rate per minute is 12-30. Sometimes it goes from 15-30. 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.

* Normal respiration rate in a Dog is 15–30 per minute.
* Normal respiration rate in a Cow is 10–40 per minute.
* Normal respiration rate in a Sheep/Goat is 10–30 per minute.
* Normal respiration rate in a Rabbit is 50–60 per minute.
* Normal respiration rate in a Cat is 20–30 per minute.
* Normal respiration rate in a Swine is 8–18 per minute

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 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 toxaemia 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.

Cattle and Buffalo	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 193

Subcutaneous emphysema). Abnormalities of abdominal and urogenital organs can be felt by rectal palpation.

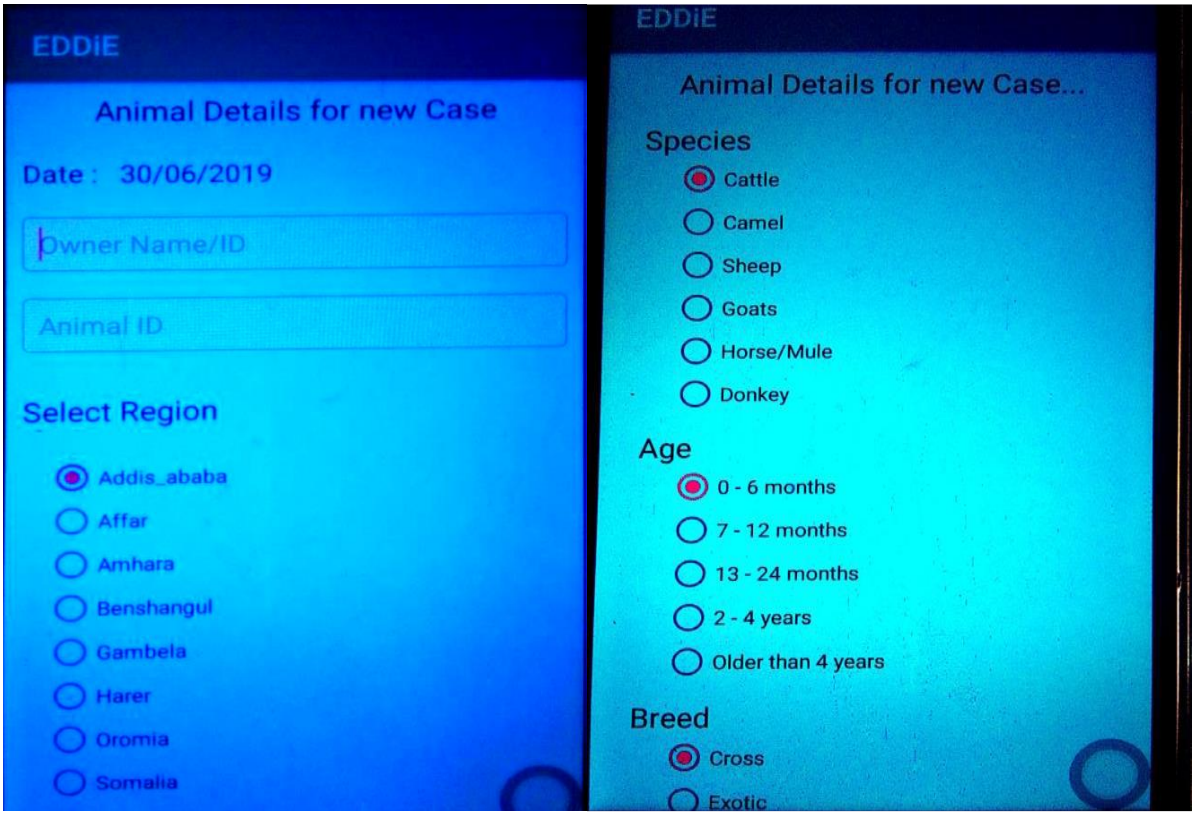
Percussion:

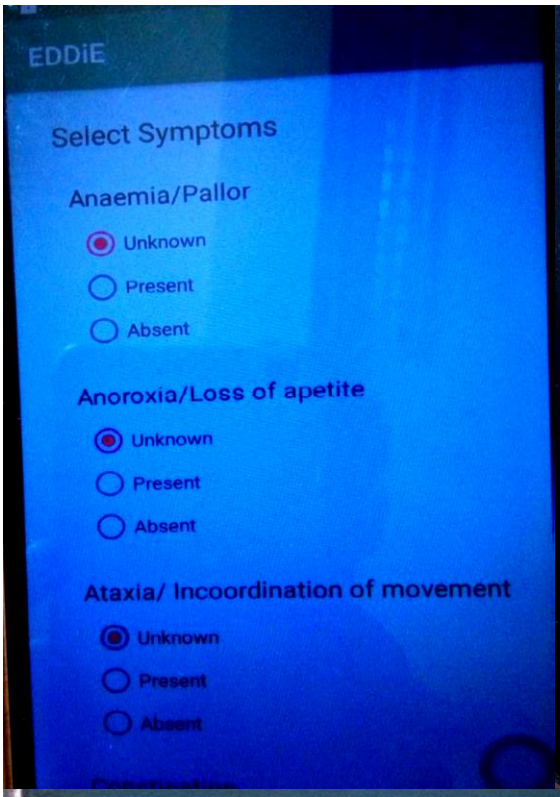
Striking of any part of the body with a short, sharp blow that enables underlying organs to vibrate and generate an audible sound is called percussion. Drum like sound audible from rumen indicates tympanitis, dull resonance in impaction. Hyper resonant sound is observed while the lungs are filled with excessive air. Increased amount of gases will emit tympanic sound in abdomen. This method is useful in small animals than the large animals.

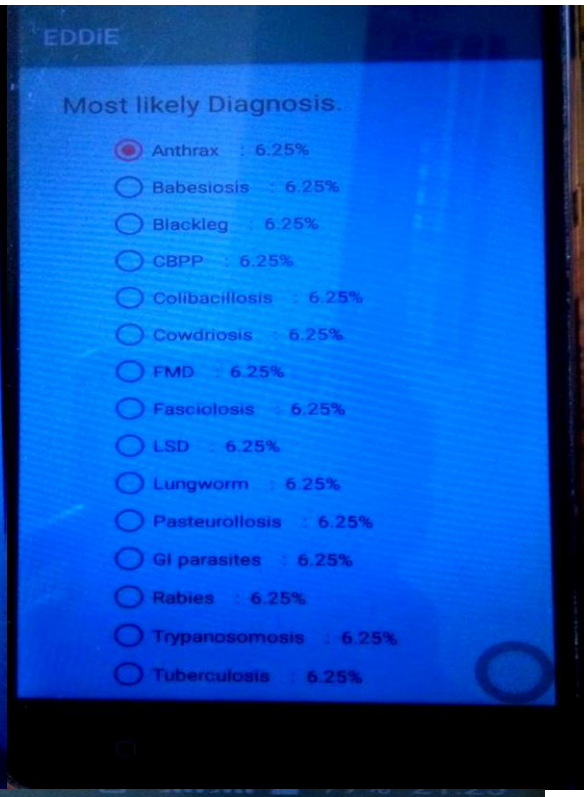
Auscultation:

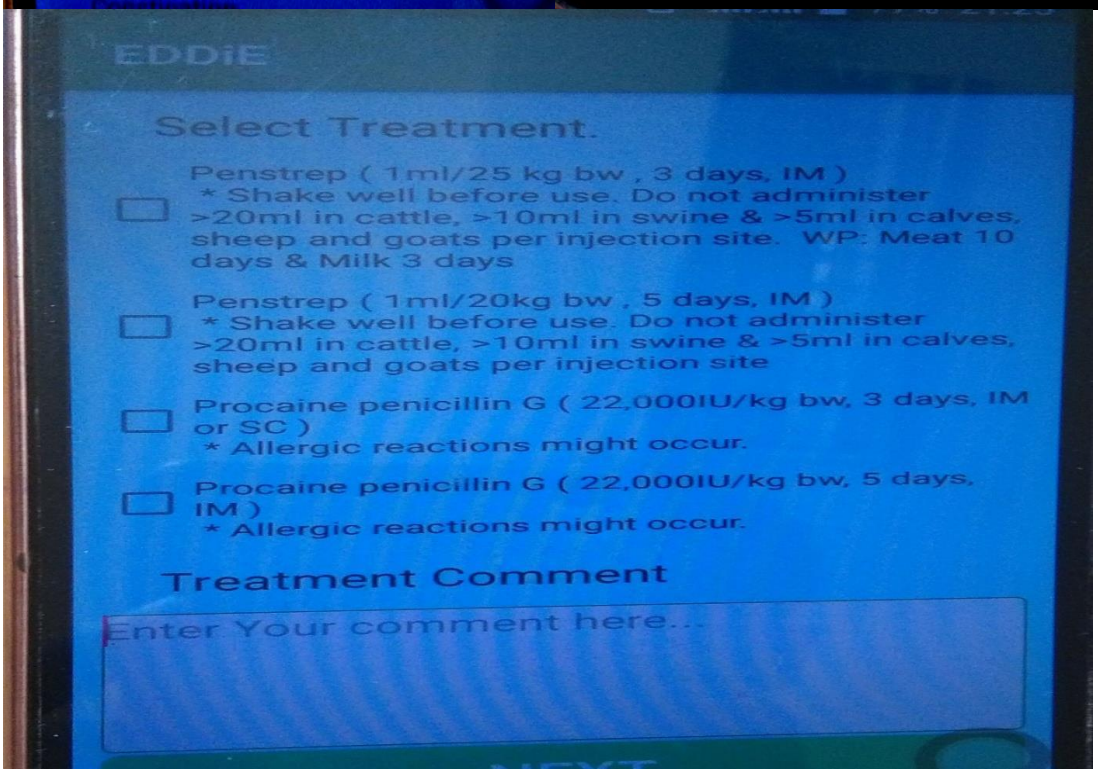
It means listening of various functional sounds produced by some thoracic and abdominal organs by use of stethoscope for ascertaining the pathological condition of lungs, pleura, heart and certain parts of alimentary tract. It is useful for hearing peristaltic sounds during ruminal and intestinal contractions, 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 How EDDIE works




EDDiE
Select Symptoms
Anaemia/Pallor
Unknown
Present
Absent
Anoroxia/Loss of apetite
Unknown
Present
Absent
Ataxia/ Incoordination of movement
Unknown
Present
Absent


EDDiE
Most likely Diagnosis.
Anthrax : 6.25%
Babesiosis : 6.25%
Blackleg : 6.25%
CBPP : 6.25%
Colibacillosis : 6.25%
Cowdriosis : 6.25%
FMD : 6.25%
Fasciolosis : 6.25%
LSD : 6.25%
Lungworm : 6.25%
Pasteurollosis : 6.25%
GI parasites : 6.25%
Rabies : 6.25%
Trypanosomosis : 6.25%
Tuberculosis : 6.25%


EDDiE
Select Treatment.
Penstrep (1ml/25 kg bw , 3 days, IM)
* Shake well before use. Do not administer >20ml in cattle, >10ml in swine & >5ml in calves, sheep and goats per injection site. WP: Meat 10 days & Milk 3 days
Penstrep (1ml/20kg bw , 5 days, IM)
* Shake well before use. Do not administer >20ml in cattle, >10ml in swine & >5ml in calves, sheep and goats per injection site
Procaine penicillin G (22,000IU/kg bw, 3 days, IM or SC)
* Allergic reactions might occur.
Procaine penicillin G (22,000IU/kg bw, 5 days, IM)
* Allergic reactions might occur.
Treatment Comment
Enter Your comment here...

Annex 4 Post Mortem Examination Procedures
Adopted from (Nyaga *et al*., 2018)

Procedures followed

1. Examined the carcass externally for any pathological changes and ectoparasites
2. Wet downed the feathers with a disinfectant solution to limit the distribution of feathers during the dissection.
3. Placed the bird on its back with its feet towards us.
4. Grasped both legs and pushed down and away from the pelvis to loosen the joints.
5. Using a knife severed the joints and muscles at the pelvic joints for better visualization of any pathological changes on the muscles and checked the normality of sciatic nerve by the help of forceps and scissors
6. Tented the skin over the abdomen and cut with scissors
7. Removed the skin overlying the abdomen and breast
8. Examined the breast muscle for decreased muscle mass, paleness (anemia), or bruising.
9. Incised the abdominal muscle and cut through the ribs on the sides of the keel bone.
10. Grasped the keel near the abdomen and pulled upwards to expose the internal organs and chest cavity.
11. Examined the air sacs for increased thickness and increased cloudiness.
12. Examined the liver for changes in size or discoloration, white or yellow spots, abscesses, and/or tumors.
13. Had Cut all attachments close to the intestines and set the GI tract aside.
14. Removed the proventriculus, ventriculus, small intestines, large intestine, ceca, and cut off at the level of the cloaca. later, these organs were opened up and examined for pathological changes and internal parasites
15. Removed the lung, liver, heart,spleen, and associated tissues to examine separately for any pathological changes
16. Examined the kidneys and tissues around it
17. Next, turned the bird around to our face and cut through the corner of the beak.
18. Extended the cut through the throat and down towards the heart.
19. Next, cut through the larynx, trachea, and syrinx, and examined for any changes

20. Examined the interior surface of the oropharynx, esophagus and crop. Looked for the presence of food (in crop) and/or parasites (worms) and pathological changes.
21. Turned the bird back to the previous positioning feet in front of us.
22. Had cut through the cloaca and looked bursa of Fabricius, and examined it for any pathological changes.
23. Then, returned to the GI tract and started with the proventriculus, cut lengthwise and examined
24. Then, had cut through the ventriculus, intestines, and ceca. Examined for any changes from normal. In this case, there were clotted blood) hemorrhage in the caecum and it was sampled for laboratory diagnosis.
25. Disposed the carcass properly and cleaned surfaces and tools.