RETROSPECTIVE STUDY OF THE PREVALENCE OF TICK-BORNE HEMOPARASITES IN CATTLE AS REPORTED FROM THE LABORATORY IN THE NORTH RIFT REGION OF KENYA

DECLARATION

I the undersigned, declare that this research project is my original work and has not been submitted for the award of degree/diploma in any other institution. No part of this project may be produced without permission of the researcher.

NAME:é é é é é é é é é é é é é .SIGNé é é é é é é é é DATEé é é é ..

This research project has been submitted for examination with my approval as the university supervisor.

PROF

NAME:é é é é é é é é é é é é é SIGNé é é é é é é é é ..DATEé é é é é é .

DEDICATION

To my Loving parents, siblings, relatives and friends.

God bless you all.

ACKNOWLEDGEMENT

I would like to give thanks to the Almighty God in heaven for His grace and mercy in my life and also enabling me to complete this study. Sincere gratitude also goes to my family members and friends for their financial and moral support during my study.

I am grateful to the University of Nairobi staff both teaching and non-teaching for their contribution towards my studies while at school. I am grateful to my supervisor Prof J. C. Kiptoon for his guidance during this study, Indeed I was able to learn very much from you.

My sincere gratitude to the University of Nairobi Seventh-Day Adventists for the spiritual nourishment and shaping my moral character which imparted in me during my life in the University.

May the good Lord bless you all, Amen

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LIST OF ABBREVIATIONS

FNI – Fine needle aspirate

RVIL – Regional Veterinary Investigation Laboratory

ECF – East Coast Fever

Mg/Kg BW – Milligrams per Kilogram Body Weight

US$ - United States Dollars

PCR – Polymerase Chain Reaction

NPS – No parasite seen

B – Babesiosis

A – Anaplasmosis

ECF + B – East Coast Fever + Babesiosis

ECF + A – East Coast Fever + Anaplasmosis

A+B – Anaplasmosis + Babesiosis

ABSTRACT

The title of my project isretrospective study of the prevalence of tick-borne hemoparasites in cattle as reported from the laboratory in the north rift region of Kenya , Smears including blood, glandular, fine needle aspirate (FNI) and impression smears are used as a diagnostic tool in Veterinary practice. There are six government Regional Veterinary Investigation laboratories (RVIL) in Kenya namely Nakuru,Kericho, Eldoret, Karatina, Mariakani and Garissa. This project was carried out at RVIL Eldoret which is situated in Eldoret town in Kenya and serves Northern parts of Rift Valley and has a satellite in Lodwar town.

Eldoret town is situated western part of Kenya and south of Cherangani hills. It is 313 Kilometers from Nairobi city with a varying altitude of 2100 meters above the sea level to 2700 meters above the sea level in some areas bordering the town.

RVIL Eldoret is a government laboratory serving North Rift part of Kenya and is headed by four Veterinarians holding the post of director, assistant director and two veterinary officers. There are also animal health technologists and other subordinate staff.

During this investigation, eight hundred and eighty nine (889) Bovine smears were reviewed at the laboratory which was prepared from blood, Organ impression, Fine needle aspirate and glandular secretions all stained using Geimsa stain but few using Gram stain. These were slides received at the laboratory for a period of five years from 2007 to 2011.

The purpose of this project was to identify the tick borne hemoparasites in Northern Rift Valley of Kenya and document their prevalence rates by viewing smears preserved at the laboratory. The microscopic examinations revealed the presents of other pathogenic organisms in the laboratory especially from whole carcasses or organs referred to the laboratory.

The results showed that there is high incidence rate of tick borne hemoparasites in North Rift region of Kenya having a 41.51% prevalence rate. It was evident that the prevalence of East Coast Fever (ECF) in Northern part of Rift Valley was high comparedto other tick borne hemoparasites with 84.55% followed by Babesiosis 6.23% then Anaplasmosis at 4.88% of 399 slides.

There was also evidence that apart from tick bornehaemoparasites, there were cases of Bacterial infections which includes Anthrax (2.25%) and Bacterial septicemia (0.11%).

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the study

North Rift Kenya is part of the former Rift valley province and is one of the most economically important provinces in Kenya, farming and Agriculture is practiced in the highlands having adequate rainfall. Livestock keeping is also practiced to a large extent in the region.

The North Rift region comprises of 6 counties namely Turkana,WestPokot, Trans-Nzoia, Uasin-Gishu, Elgeyo-Marakwet and Nandi covering an area of 91375.4 Km^2. The climate in the region varies from areas with adequate rainfall like Trans-Nzoia, Uasin- Gishu, Nandi and Elgeyo-Marakwet to arid and semi-arid areas of West Pokot and Turkana counties. Farms in this region are generally large and comprise of arable farms as well as farms with livestock or mixture of crops and animals.

Agricultural practices in this region comprise of both arable farming as well as livestock keeping and wide range of crops are grown in the highland including tea in Nandi hills and Cherangani hills to maize and wheat in Uasin-Gishu and Trans-Nzoia counties as well as livestock rearing with more of exotic breeds in the highlands under intensive or semi-intensive systems and indigenous breeds in Arid and semi-arid areas mostly small ruminants.

Contagious Bovine Pleuropneumonia (CBPP) is commonly confined to the arid and semi-arid parts while diseases like ECF and pneumonia are more on the wet high lands of the Rift valley.Rinderpest was a serious condition in the arid and semi-arid parts but was eradicated.

Many ticks act as vectors of diseases in animals;they are the most important vectors of most of the protozoan diseases. The ticks are distributed all over the North Rift Kenya with *Rhipicephalus spp* mostly in the wet regions while *Boophilus spp* found in both wet and dry parts of the region. Regular use of acaricides in dipping, spraying or pour on or injectable depending on the life cycle of the tick, pasture spraying to destroy free living stages and rearing of resistant cattle plays a role in controlling of these diseases(Otto M. Radostits, Clive C. Gay, Douglas C. Blood and Kenneth W. Hinchcliff, 2000). In some areas especially the drier counties, many people still use hand spraying in the application of acaricide while in highlands regular dipping is practiced by most of the farmers.

In the region, level of literacy is varied from illiterate farmers more so from the drier parts who practice nomadic pastoralism to the generally literate farmers from the highlands.

Tick borne diseases in cattle are all over the world but with high prevalence and significant effect in the tropical and subtropical regions. The pathogens can be protozoa as in cases of babesiosis and ECF caused by *Babesia spp* and *Theileria spp* respectively or also due to rickettsia as in cases of anaplasmosis and heartwater caused also by *Anaplasma spp* and *Cowdria spp* respectively.

1.2 Economic importance

Tick-borne diseases impact greatly on the livestock sector in tropical and sub-tropical countries. The cost associated with some of these diseases are great and ranges from poor body condition, death, abortions, reduced milk and meat production as well as cost associated with treatment, prevention and control of these diseases. Otto M. Radostits et al, (2000) points out that anaplasmosis, one of the tickborne diseases is a constraint to efficient livestock

productionlimiting the introduction of superior exotic breeds in the endemic areas of the tropics and sub tropics.

ECF has a major impact on livestock production in Africa especially eastern, central and southern Africa. Losses incurred are from reduced production of milk and meat as a result of morbidity and mortality as well as cost of treatment and control of the disease The study also reported estimates of upto 1.1 million head of cattle killed by ECF in the year 1989 which caused a loss ofmore thanUS$ 168 million (Otto M. Radostits et al, 2000).

Bovine babesiosis is the most economically important disease of all the protozoan diseases in cattle due to direct losesfrom debilitation,reduced production of milk and meat as well as cost of treatment and control (Otto M. Radostits et al, 2000).

1.3 Bovine Tick borne diseases

1.3.1 Anaplasmosis

According to Bradford P Smith (2002), anaplasmosis is the most prevalent of the tick borne-rickettsialdiseases of cattle in the world and is a major constraint to livestock production in tropical and sub-tropical regions.

This in an infectious and transmissible disease caused by various species of the genus Anaplasma and affect cattle, sheep and goats. The disease is characterized by fever, anemia and loss of body condition. *Anaplasma spp* are closely related to Ehrlichiae both genetically and antigenically(Bradford P Smith, 2002).

In cattle the clinical anaplasmosis is caused by *Anaplasmamarginale* which shows a more severe disease than *Anaplasmacentrale* which causes a mild debilitating infection. The disease is

clinically manifested by a highly variable clinical signs ranging from acute severe disease to subclinical emaciating infection (Bradford P.Smith, 2002).

According to Otto M. Radostits et al, (2000), Anaplasmosis is also manifested clinically by severe debility, emaciation, anemia and jaundice. In clinical pathology microscopic examination reveals changes in cell morphology and demonstration of the organism in red blood cells.

There are several risk factors that predisposes cattle to anaplasmosis and includes; age at infection with young animals up to 9 months showing high susceptibility but hardly showing clinical signs; geographical region where by clinical anaplasmosis is rare in enzootic areas; breed which shows equal susceptibility between both *Bos indicus* and *BosTaurus*; nutritional status with animals on feedlots or high plane of nutrition more susceptible than those on low plane of nutrition. There is also a high incidence of clinical disease during warm period when the favorable season for vectors to multiply exist (Otto M. Radostits et al, 2000).

According to Bradford P Smith (2002), Calves show mild form of the disease in the first 6 to 9 months of life with increase in severity in older cattle. Anaplasma infectionshave an incubation period of 30 days on average with typical acute severe cases being manifested by pyrexia up to 41 degrees Celsius, but drops to subnormal before the animal dies. There is also anorexia, starryhair coat, decreased milk production, suppression of rumination, dryness of muzzle and lethargy. The animal may also stagger due to anemia and hypoxia (Bradford P Smith, 2002).

Treatment of anaplasmosis is achieved by use of Tetracyclines as the drug of choice for acute disease with no resistance reported. Dosage rate is at 11 mg/kg once daily for 3 to 5 days being effective. Additional supportive therapy may be administered like whole blood transfusion in

severely anemic cases depending on the condition of the animal (Bradford P Smith, 2002). This mode of treatment may cause relapses in future.

Two injections of Imidocarbdipropionate at 5mg/kg BW intramuscularly every 7 days for 2 to 4 injections or intravenous injection of tetracyclines at a dosage rate of 22mg/kg BW for 5 days eliminates the infection and avoids relapses. This elimination of the pathogen leaves the animal susceptible to reinfection but resistant to clinical disease for some time (Otto M. Radostits et al, 2000).

Prevention and control of anaplasmosis depends on the geographical region and type of production system (Bradford P Smith, 2002). Among the options of prevention includes allowing animals in endemic areas to be naturally infected when young so as to remain asymptomatic carriers with minimal rates, or in regions the disease is not endemic, blood-based vaccines may be used. Another method is to control transmission by preventing contact between the animal and the responsible vectorswhich is difficult in grazing animals but acaricides and insecticides can reduce transmission (Bradford P Smith, 2002).

1.3.2 Bovine Babesiosis

ñBabesiosis is a tick-borne intraerythrocytic hemolytic disease of domestic and wild mammals and humans caused by protozoan parasites of the genera *Babesia* and *Theileria"* (Bradford P Smith, 2002).

Bovine Babesiosis also known as; piroplasmosis, Texas fever, red water, tick fever and Tristezamay be caused by atleast six *Babesia*species of great concern being *Babesiabigemina*and *Babesiabovis.*Naturally the disease is transmitted by the one-host tick of genus *Boophilus* (Bradford P Smith, 2002).

According to Otto M. Radostits et al, (2000) *Babesia bigemina* and *Babesiabovis* infections are exclusively limited to tropical and subtropical regions and clinically manifested by anemia, hemoglobinuria, jaundice, fever and heavy case fatality.

Clinical signs of Bovine babesiosis include fever up to 42 degrees Celsius, depression, icterus, anorexia,tachypnea, tachycardia, anaemia, hamoglobinuria, hemoglobinemia, abortion and death. Anemia is caused by lysis of erythrocytes by the merozoites as they escape to invade new erythrocytes (Bradford P Smith, 2002).

Treatment involves use of babesiacides and the most commonly used being diminazine diaceturate (Berinil) at a dosage rate of 3 to 5 mg/kg BW or Imidocarb dipropionate (Imizol) at a dosage rate of 1 to 3 mg/kg BW. Prevention is by controlling the tick vector using acaricides and also use of vaccines in some countries have been successful (Bradford P Smith, 2002).

Bovine babesiosis can be controlled by controlling tick vector, vaccination with live vaccine or chemoprophylaxis with Imidocarbdipropionate (Otto M. Radostits et al, 2000).

1.3.3 East Coast Fever (ECF)

Classical ECF occurs in East Africacaused by *Theileria parva;* a protozoan hemoparasite of cattle transmitted by tick *Rhipicephalusappendiculatus* .The occurrence of ECF is related to the vector distribution and the disease is more prevalent in wetter areas which favor tick growth but the disease has not been reported in the wet highlands in the horn of Africa (Otto M. Radostits et al, 2000).

Otto M. Radostits et al, (2000) shows that clinical signs of the disease include fever, enlarged superficial lymph nodes, dyspnea, wasting and terminal diarrhea.

Treatment of ECF is by use of halofuginone, parvaquone and tetracyclines and has limited success. 2 doses of bupavarquone 48 hours apart at a dosage rate of 2.5 mg/kg BW given intramuscularly is effective in most of the times. ECF is controlled by breaking the cycle of transmission between ticks and cattle by use of acaricides (Otto M. Radostits et al, 2000).

1.4 Objectives and Justification

1.4.1 General objective

To identify the tick borne hemoparasites and their prevalence rates as reported in RVIL Eldoret in North Rift part of Kenya by carrying out a retrospective study of bovine smears preserved at the RVIL.

1.4.2 Specific objectives

1. To identify tick borne hemoparasites in cattle by viewing tissue and organ smears for a period of five years in RVIL Eldoret.
2. To calculate and document prevalence rates of tick borne hemoparasitesin cattle as shown by tissue and organ smears from the laboratory.

1.5 Justification

It was justified to carry out a retrospective study of the prevalence of tick-borne hemoparasites in cattle in North Rift part of Kenya since livestock especially cattle play a key role in the economy of the people living in this region.

Tick borne diseases are the major constraints of livestock production in the tropics and in many areas has limited introduction of the exotic breeds of cattle hence lowering milk production. There are a lot of cost incurred due to tick borne diseases which is as a result of both morbidity and mortality and cost incurred in prevention, control and treatment of the

sick animals. According to Otto M. Radostits et al, (2000), anaplasmosis, one of the tickborne diseases is a constraint to efficient livestock production and has limited the introduction of superior exotic breeds in the endemic areas of the tropics and sub tropics.

Otto M. Radostits et al (2000) shows that Babesiosis is most significant protozoan disease in the tropical and sub-tropical regions of the world. East coast fever also has great impact on livestock sector and according to Otto M. Radostits et al (2000), an estimate of 1.1 million head of cattle was killed by ECF in the year 1989 which caused US$ 168 million loss.

1.6 Limitation

Not all veterinarians and animal health technologists send samples to the laboratory and samples were not received from the entire North Rift part of Kenya hence the prevalence rate shown by the study may not be the exact situation in the region.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Anaplasmosis

This is a Rickettsial disease in cattle caused by *Anaplasma marginale* and *Anaplasma centrale* organism transmitted by *Boophilus spp* ticks and mechanically by biting flies the Tabanids. Itôs a common disease in the Tropic and sub-tropic regions and sporadic in the temperate region. The disease leads to emaciation, anemia and icterus, severe debility and death (Otto M Radostits, Clive C Gay, Kenneth W Hinchcliff & Peter D Constable, 2006).

Diagnosis of the disease is history, clinical signs and presence of the vector; to confirm the diagnosis either serology or Polymerase chain reaction (PCR) can be done or more commonly demonstration of the parasite in erythrocytes whereby inclusion bodies situated either centrally or marginally in erythrocytes are demonstrated in blood smears stained using Geimsa (Otto M Radostits et al 2006).

According to Bradford P Smith (2002), Anaplasmosis is an infectious transmissible disease of cattle, sheep and goats; it is caused by a protozoan parasite of genus Anaplasma which are genetically as well as antigenically similar to ehrlichia. The disease is most prevalent in tropics and sub-tropics and is a serious constraint to livestock production in the above regions. Demonstration of Anaplasma infected erythrocytes in a blood smear from affected cattle is the confirmatory diagnosis of anaplasmosis (Bradford P Smith, 2002).

2.2 Babesiosis

Babesiosis is a protozoan disease caused by *Babesia spp.* According to Otto M Radostits et al (2006), there are four Babesia species now recognized in cattle and includes *Babesia bigemina, Babesia bovis, Babesia divergen s*and *Babesia major.* The distribution of the disease is governed by the vector tick*Boophilus spp* and is an important disease in the tropics and sub-tropics.

The disease is confirmed by positive serology, PCR for parasite in blood or stained blood smear to demonstrate the parasite in erythrocytes Otto M Radostits et al (2006).

Bovine Babesiosis also known as piroplasmosis, Texas fever, red water, tick fever and tristeza affects not only cattle but also white-tailed deer, American bison, water buffalo, rein deer and African buffalo. The main parasite in cattle is: *Babesia bigemina* and *Babesia bovis*. *Babesia bigemina* appears in erythrocytes as large non-pigmented, pear shaped and in pairs while *Babesia bovis* are smaller and pleomorphic often appears singly.Demonstration of these parasites in erythrocytes is a confirmatory diagnosis (Bradford P Smith, 2002).

2.3 East Coast Fever (ECF)

According to Otto M Radostits et al (2006), ECF is an endemic disease in East and Central Africa. It is caused by *Theileria parva parva* a protozoan pathogen transmitted by *Rhepicephulus appendiculatus* tick commonly referred to as Brown ear tick.

Confirmatory diagnosis is by serology or demonstration of schizonts in lymphoblast or piroplasm in erythrocytes (Otto M Radostits et al, 2006).

According to Bradford P Smith (2002), East Coast Fever also known as Theileriasis is caused by a small hemoparasite of the genus *Theileria* which infects erythrocytes and lymphocytes in ruminants in tropical and sub-tropical climate. The disease is highly fatal when caused by

Theileria parva while other members of the genus *Theileria* like *Theileria hirci*, *Theileria mutan* and *Theileria annulata* are less pathogenic.

The disease is confirmed by demonstration of blue cytoplasmic inclusion bodies (Kochôs blue bodies) in lymphocytes or piroplasm in erythrocytes (Bradford P Smith, 2002).

CHAPTER THREE

3.0 RESEARCH DESIGN AND METHODOLOGY

3.1 Research Design

The research design refers to the strategy one employs in a study to ensure all components of the study are incorporated in a logical and coherent way in order to effectively address the research problem. This comprises of the collection and analysis of data (De Vaus, D. A. Research Design in Social Research, London: SAGE, 2011; Trochim, William M.K Research Methods knowledge Base, 2006).

The research design in this project is a retrospective study and according to Hess (2004), retrospective research requires data that were initially collected for other purposes other than research. This includes nursesôreports, admission and discharge files, clinical reports and laboratory diagnostic test report. These data have been of great importance and for the past eight decades, a systematic study of the data has guided various researches (Butler and Quinlan, 1958).

3.2 Target population

The RVIL Eldoret serves the Northern part of Rift valley and has a satellite laboratory in Lodwar town. The samples to the laboratory majorly are from the Veterinarians practicing within the region who submit thesamples for confirmatory diagnosis. Blood smears, glandular smears, organ impression smears as well as Fine needle aspirate (FNI)are stained and observed at the laboratory and a comprehensive record of all smears kept also, all smears are well kept.

3.3 **Description of samples and sampling procedures**

3.3.1Sample taking

The samples are usually collected to aid in confirming a tentative diagnosis arrived at by the Veterinarian always accompanied by a clear case history, gross appearance and clinical signs to help the personnel at the laboratory in determining the diagnosis. Blood smear samples in cattle are made from immediately collected blood from the tip of the tail, or blood from the tail vein taken for other blood test and is done in the field by the clinician.

When making a blood smear the following guidelines are always followed; a clean slide is always used, size of drop is also such that itôs a good representative of blood and not too big to form a thick smear. When making the smear, even contact is ensured and an angle of 45^0 maintained between the slide and the spreader.

The smear is then air dried, wrapped in a paper and ferried to the laboratory by car where fixing and staining is done before observation.

This study deals with tissue and organ smears at the laboratory with the goal of establishing the prevalence rate of various tick borne hemoparasites in cattle. In this study, the researcher viewed Bovine slides for a period of five years from the year 2007 to 2011, the researcher chose this period as it was the time where all the records were available and well kept. A total of eight hundred and eighty nine (889) smears were viewed. Most the smears were stained using Giemsa stain with a few stained using Gram stain.

3.4 Description of Research instruments

This research was carried out in the laboratory and it involved viewing of tissue and organ smears from Bovine which had been prepared before. The instruments used during the research includes: A light Microscope, Glass slide with smears mounted on the microscope under oil immersion and recording materials. The microscopes at the laboratory had magnification of between x 10 and x 100 for the revolving nosepiece and x 10 for the eyepiece lens. The slides were observed under x 1000 magnification under oil immersion.

3.5 Description of data collection procedures

The researcher first settled on the period that had all the smears well-kept and this was from the year 2007 to 2011, then the data was collected by viewing all the slides and recording what the researcher found out. The results were either positive of a Parasite on negative. For those with parasites, the researcher was able to identify as either tick borne hemoparasite or other pathogens. The researcher also identified the specific species of the tick borne hemoparasites.

3.6 Data analysis procedures

The data obtained from the study was recorded, summarized, coded and analyzed to arrive at a meaning. From the data, percentages of various variables were calculated and using the Excel Microsoft put in tables, pie charts, Bar graphs and column graphs.Conclusions and recommendations were drawn based on the analyzed data.

3.7 Validity and reliability of research instruments

Validity is the accuracy of the research and it points out how sound the research is. This is one of the main concerns in research. ñAny research can be affected by different kind of factors which,

while extraneous to the concerns of the research can invalidate the findingsò (Seliger&Shohamy 1989/95)

Reliability in research refers to the measure of quality; it is the measure of degree in which an instrument produces the same results in repeated trials. It is affected by the random error (Mugenda and Mugenda, 2003).

CHAPTER FOUR

4.0 DATA ANALYSIS DISCUSSION AND INTERPRETATION

4.1 Presentation and interpretation of research findings

A total of eight hundred and eighty nine (889) tissue and organ smears were observed under the microscope and four hundred and ninety nine (499)smears were negative of any parasite, three hundred and twelve (312) were positive of ECF showing piroplasms or Kochôs blue bodies for blood and glandular smear respectively.

Twenty threes (23) smears were positive of *Babesia* parasites, there were eighteen (18) smears were positive of anaplasmosis. There were also cases of mixed infection whereby one (1) smear had more than one parasite. The researcher found seven smears (7) with both *Theileriaparva* and *Anaplasma spp* while six smears (6) had both *Theileriaparva*and *Babesia spp.*There were three smears (3) with both *Babesia spp* and *Anaplasma spp.*

There were also bacteria viewed by the researcher during research and were twenty (20) smears positive of *Bacillus anthracis* and one (1) smear positive of *Pasteurella spp.*

Table 1-1showing the results after microscopic examination of bovine tissue and organ smears

Results under the microscope	Number of smears	Percentage (%)
No parasite seen	499	56.13
Theileriaparva	312	35.10
Anaplasma spp	18	2.02
Babesia spp	23	2.59
Theileriaparva and *Anaplasma spp*	7	0.79
*Theileriaparva*and *Babesia spp*	6	0.67
Babesia spp and *Anaplasma spp.*	3	0.34
Bacteria	21	2.36
Total	889	100

Figure 1 Showing prevalence rates of each Bovine hemoparasite as demonstrated under the microscope.

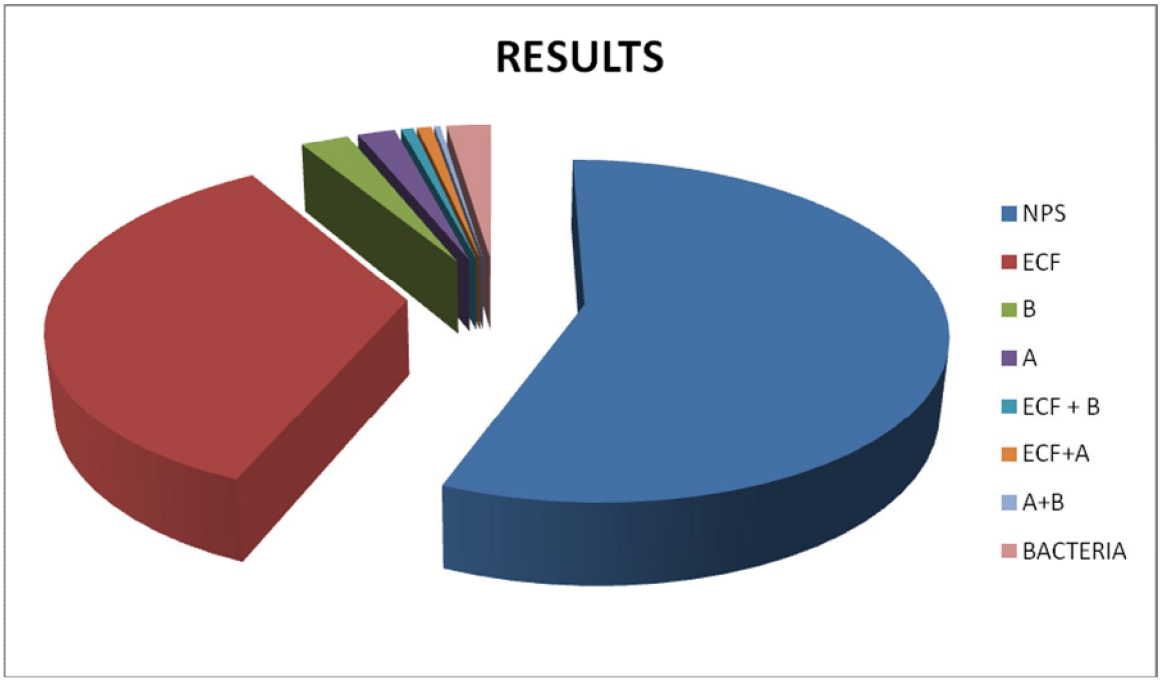
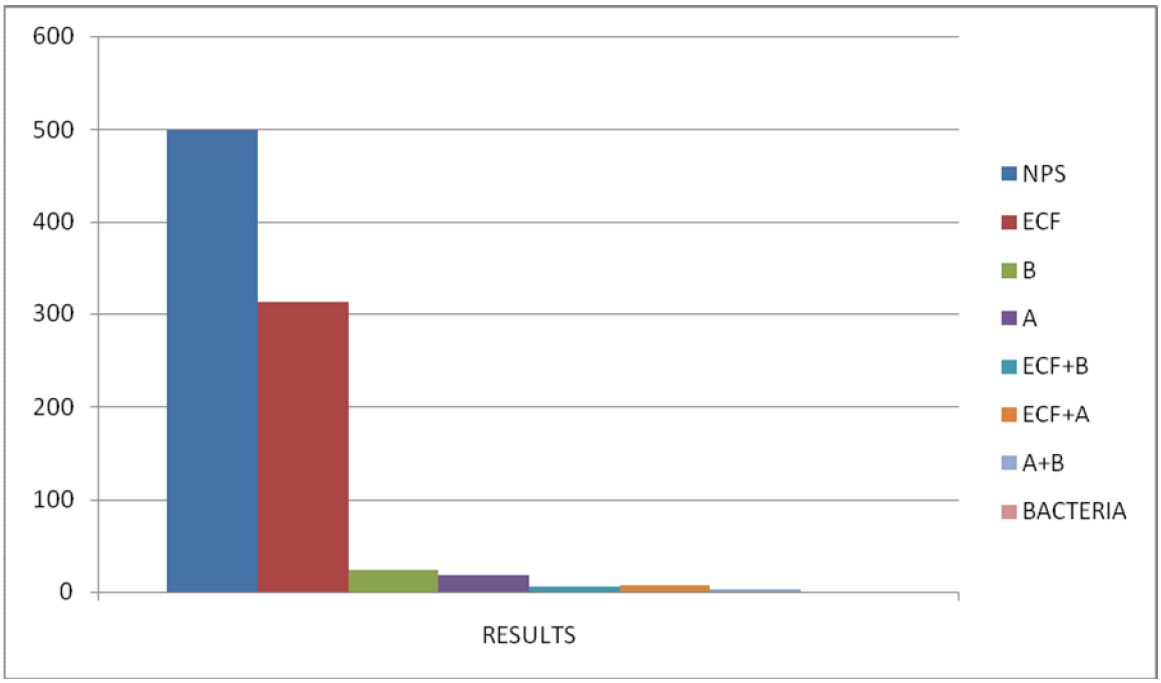


Figure 2 Showing prevalence rates of each Bovine hemoparasite as demonstrated under the microscope.



The results showed that there is high prevalence rate of tick borne hemoparasites in North Rift region of Kenya where by ECF caused by *Theileria parva*, Babesiosis caused by *Babesia bigemina* and *Babesia bovis* and anaplasmosis caused by *Anaplasma marginale*and *Anaplasma central* are the main diseases in the region.

According to D.T. De Waal (2012) diagnosing parasites requires a highly specific and sensitive technique and microscopy as one of the conventional methods do not always meet that standard. 56.13% of the smears had no parasite demonstrated and this could be due to the fact that no pathogen hence true negative or due to errors during sample collection and staining hence giving false negatives.

Table 1-2: Showing the prevalence of hemoparasites after Microscopic examination

Results	Number of smears	Percentage (%)
NPS	499	56.13
Hemoparasites	369	41.51
Bacteria	21	2.36
Total	889	100

Figure 3: Showing prevalence rates of Bovine hemoparasites

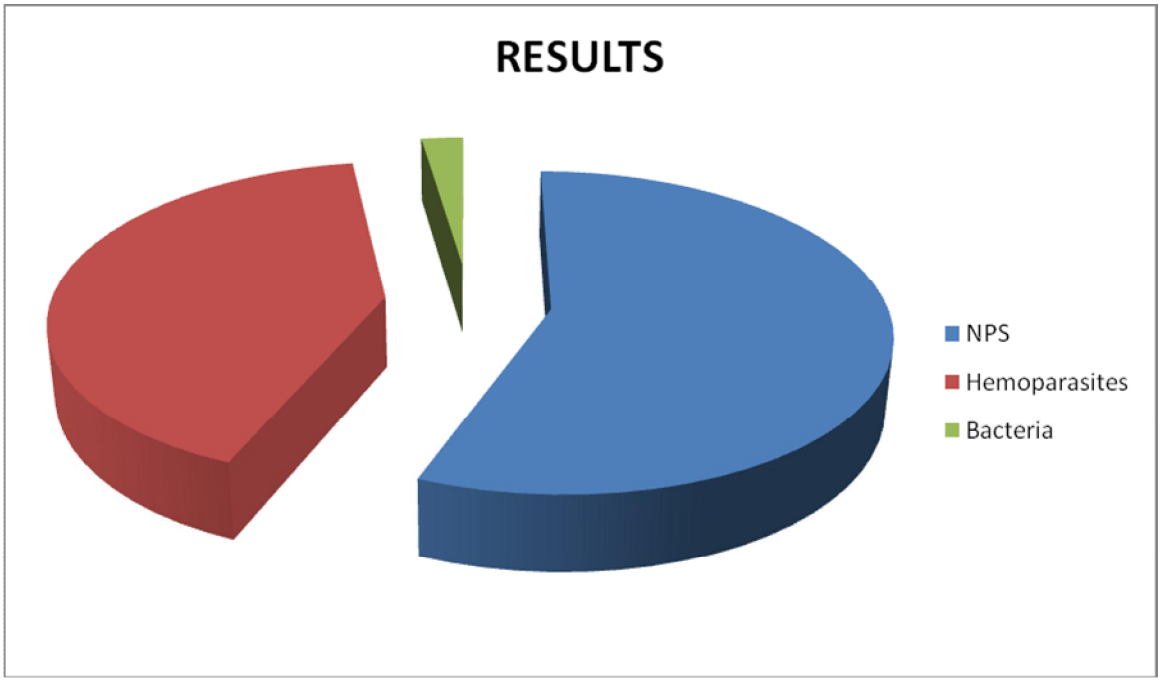
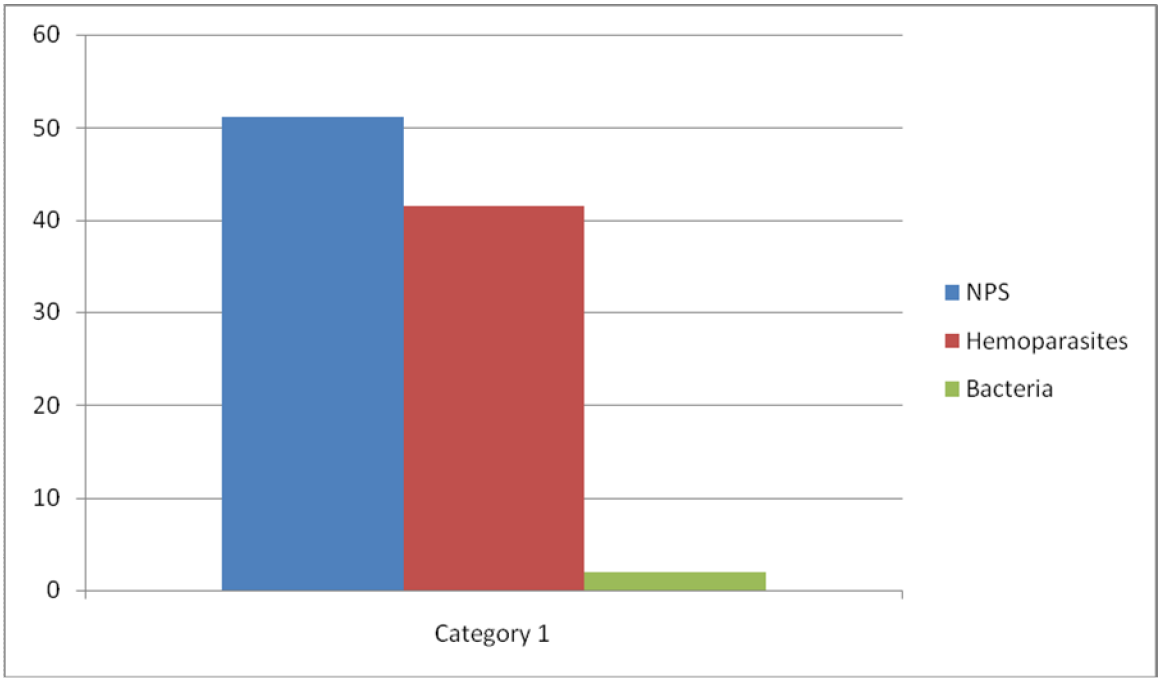


Figure 4: Showing prevalence rates of Bovine hemoparasites



From the results, its deduced that tick borne diseases have high prevalence rates in the region served by the laboratory with 41.51% of 889 tissue and organ smears viewed by the researcher showing positive of hemoparasites. Tick control in North Rift parts of Kenya involves various methods whereby few areas still have the communal dipping of cattle, some do spraying and there are some who donôt control ticks at all. This high prevalence rate could therefore be associated with ineffective tick control measures which are the main vectors of the pathogens.

There is also bacterial infection the major one being Anthrax caused by the spore forming bacteria *Bacillus anthacis* showing a prevalence rate of 2.36% of 889 tissue and organ smears viewed.

Table 1-3: Showing prevalence of each hemoparasite as seen under the microscope

Hemoparasite	Number of slides	Percentage (%)
Theileriaparva	312	84.55
Babesia spp	23	6.23
Anaplasma spp	18	4.88
Mixed	16	4.34
Total	369	100

Figure 5: Showing prevalence of each hemoparasite as seen under the microscope

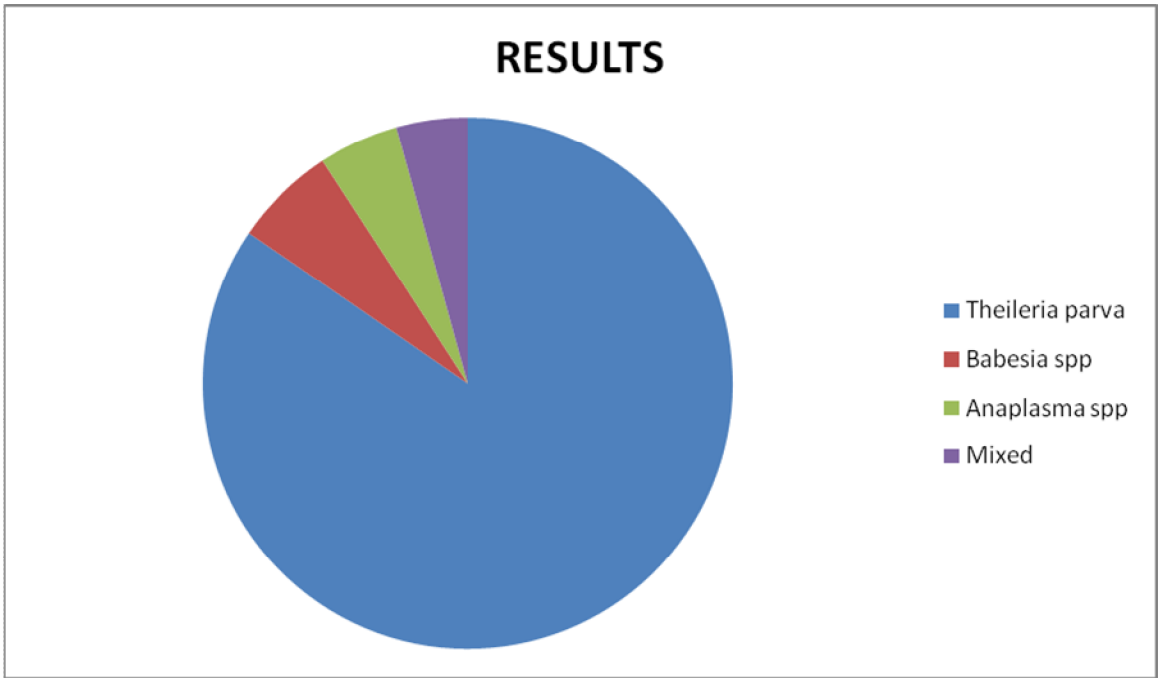
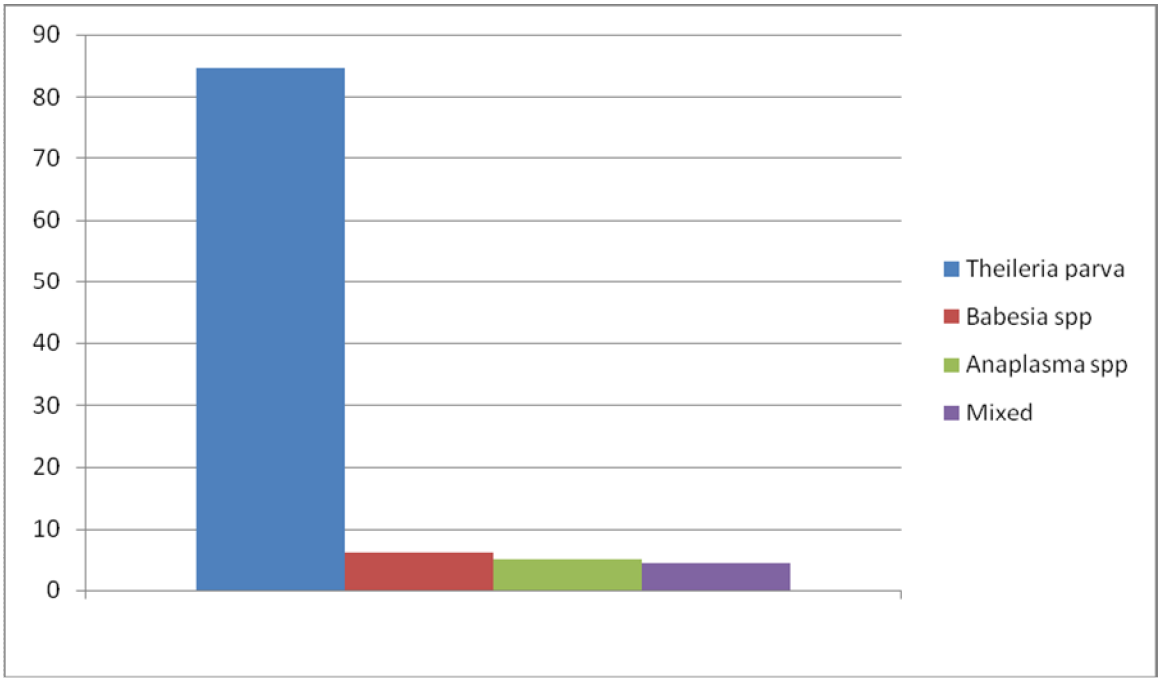


Figure 6: Showing prevalence of each hemoparasite as seen under the microscope



The results show that of the hemoparasites, Theileria parva is of major concern in this region being 84.55% of 399positive hemoparasites smears viewed followed by Babesia spp (6.23%) and Anaplasma spp (4.88%). There were also smears with mixed infection by two of the three hemoparasites with a percentage of 4.34% of all the cases. This shows that there may be regions with more than one vector tick or due to ill health that encourages proliferation of latent hemoparasites.

CHAPTER FIVE

5.0 Conclusions and Recommendation

5.1 Conclusions

1. The results confirmed the study hypothesis that there was high prevalence rate of tick borne hemoparasites in North Rift region of Kenya. The evidence showed that tick borne diseases more so ECF, Babesiosis and Anaplasmosis are still a major problem in the region.These results could be attributed to the ineffective tick control measures in North Rift Kenya whereby there is variation in controlling ticks ranging from no control at all to use of communal dips or spraying of cattle by individuals.
2. The evidence also points out that of the tick borne diseases, ECF is a major concern with the highest prevalence rate of 84.55% of 399 smears positive of hemoparasites. This means that there is increased cost to cattle production in the region as the farmers incur veterinary cost and also losses from mortality or reduced milk and meat production due to the severity of the disease. Therefore there is great impact on the human population in the region more so the pastoralist who lives in the drier areas of the region and who fully relies on livestock for living.

5.2 Recommendations

From this study, it is clear that there is high prevalence of tick borne diseases in the North Rift parts of Kenya the main ones being ECF, Anaplasmosis and Babesiosis. This points out that there is a problem that needs to be addressed in the control of vectors especially ticks and this study recommends further study on effectiveness of tick as well as other vectors control measures in the North Rift parts of Kenya.

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