PREVALENCE AND CONTROL OF SHEEP NEMATODES IN KANYARIRI UNIVERSITY FARM, KIAMBU COUNTY, KENYA

A project report submitted in partial fulfillment of the requirements for the award of the degree of bachelor of veterinary medicine, University of Nairobi

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DECLARATION

I hereby declare that this project is my original work and has never been submitted to any other university or institution of higher learning for the award of any degree.

Signed…………………………..

Date……………………………..

Japhet Nyakundi Nyamweya

This project has been submitted for examination with mu approval and a as a partial requirement for the degree of bachelor in Veterinary Medicine.

Signed……………………………

Date………………………………………

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DEDICATION

To my mother, Hellen Bosibori Abua and my dad, James Nyamweya Ongondo, in recognition and appreciation of the roles they have played in my life, transforming me from a boy to the great man I see in now.

ACKNOWLEDGEMENTS

First I thank God for the good health, life and opportunities he has given me during the period.

My gratitude goes to my supervisor Dr. R. M. Waruiru for his guidance and supervision throughout the period of the project, University of Nairobi Veterinary farm workers for their co-operation and patience during the sample collection together with all my classmates whom all I can not name them here for their great encouragement and support during my project. Lastly, but not least I sincerely thank the Department of Veterinary Pathology, Microbiology and Parasitology for the support extended to me.

Thanks to Almighty God for His blessings during my project.

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ABSTRACT

A study was conducted to determine the prevalence and control of nematodes of sheep in the University of Nairobi Veterinary Farm, Kanyariri. Sixty fecal samples were collected from the rectum of sheep from the farm on 20th March 2015. Samples were then analyzed for nematode eggs and coccidial occysts were also counted. All the positive samples were cultured and the emerging infective larvae (L_3) and sporulated ooccysts identified.

The results indicated that the level of nematode infestation was low 339 eggs per gram of feces in avarege in 2015 compared to an average of 2350 eggs per gram of feces with similar study done by Nabi Oki in January 2013. The study also found out that, 4 male weaners who were confined and on a different diet from the rest of the flock had an average 875 EPG compared to that of the flock at an average of 339 EPG. The study also found that the closamectin drench used in the farm was able to control the nematode infestation to levels low enough for profitable production of sheep during the period of study.

The study also found out that the coccidial oocyst counts declined with age while the fecal egg counts also decreased with age but stress in the sheep lead to increase of fecal egg counts at any age.

CHAPTER ONE: INTRODUCTION

Agriculture currently contributes 24% of the gross domestic product and is the main activity in Kenya. Of this the livestock sector contributes 45% which is approximately $ 4.54 billion US dollars (ksh. 318.971 billion). The livestock industry in Kenya has cattle, goats, sheep, and camels as the larger portion of animals .Kenyan livestock populations estimates National 2009 population census Cattle 17,467,774; Sheep 17,129,606; Goats 27,740,153; Camels 2,971,111; Donkeys 1,832,519.

In Kenya sheep are mainly kept in ranches by companies or privately owned by pastoral communities in the arid and semi arid areas and they are also reared in region receiving high rainfall. The varied regions where sheep are reared have unique challenges to farmer in those regions. However, despite the different climatic conditions the problem of nematode diseases is common to all regions and has marked impact on sheep production. The problem is greatest in high rainfall areas because of the favorable environment for continuous development of nematodes.

The nematodes cause direct and indirect losses to farmers. The direct losses caused by these parasites are attributed to acute illness and death, premature slaughter and rejection of some parts at meat inspection. Indirect losses include the diminution of productive potential such as decreased growth rate, weight loss in young growing animals and late maturity of slaughter stock (Hansen and Perry 1994). The infections are either clinical or sub clinical, the latter being the most common and of great economic importance (Allonby and Urquhart1972. The financial and agriculture losses caused by parasites have a substantial impact on farm profitability.

Given the significant problems with drug resistance, there is need for regular surveillance of the nematode diseases especially early in the grazing season and later in the grazing season to increase focus on understanding the epidemiology of parasites, in order to work toward better strategic and integrated approaches of parasite control.

1.1 **Statement of the problem**

Currently in Kenya and the world at large the demand of animal protein is on the rise. This is propelled by huge population growth and increase of middle class people in the world who are willing to pay for the commodity. If the demand for these products is not met there will be increased cases of malnutrition in people.

Despite the huge demand for the animal protein sources the supply of the product to the market has been constrained. This is due to the scarcity of resources which has been augmented with emerging issue like climate change and fatal diseases and the little resources allocated to the industry are shifted elsewhere.

The intensification of the livestock sector including sheep farming has led to huge problems of lack of quality feed, heavy worm burden and antihelmintic reistance. The current financial losses of about $25 million dollars in Kenya caused by *Hemonchus contortus* alone suggest a lot has to be gained by enhancing key parasitic disease control.

1.2 **Justification of the statement**

When the nematode problem be overcome there will be improved sheep productivity and more profit to the farmers. This will make the business lucrative which will translate to increase supply of the commodity to the market, this will in turn lead to employment and assist in fighting malnutrition

1.3 Broad objective

- To improve productivity of sheep

1.3.1 Specific objective

- To identify the specific nematodes found in the area
- To assess the levels of infestation of sheep by nematodes
- To assess the effectiveness of the employed nematode control strategies in the area

1.4 Hypothesis

Null hypothesis

Nematode infestation in Kanyariri University Farm is prevalent and control strategies applied are effective.

Alternative hypothesis

Nematode infestation in Kanyariri University Farm is not prevalent and the control strategies are ineffective

CHAPTER TWO: LITERATURE REVIEW

In epidemiology, point prevalence is a measure of the proportion of animals in a population who have a disease or condition at a particular time, such as a particular date. It is like a snap shot of the disease in time.

2.1 Epidemiology

2.1.1 Aetiologies

- *Haemonchus_contortus*. Commonly known as Barber's pole worms or red stomach worm. Found in the Stomach. Number one worm problem in sheep and goats in warm and moist regions worldwide. Mostly in mixed infections.
- *Bunostomum* spp. Commonly known as Hookworms. Found in the Small intestines. Mostly in mixed infections, worldwide, mainly in warm and moist regions.
- *Chabertia ovina*. Commonly known as large-mouthed bowel worm of the large intestine. Worldwide. Mostly in mixed infections.
- *Cooperia* spp. Found in small intestines. Mostly in mixed infections, worldwide, mainly in warm and moist regions
- *Gongylonema* spp. Commonly known as esophagus and stomach. Mostly a secondary issue. Worldwide.
- *Mecistocirrus digitatus*. Found in the Stomach. Usually a secondary issue. Mostly in mixed infections. Worldwide, mainly in warm and moist regions worldwide.
- *Nematodirus* spp. Commonly known as thread-necked worm. Found in the small intestine. Mostly in mixed infections. Worldwide, mainly in regions with temperate climate.

- *Oesophagostomum* spp. Commonly known as nodular worm. Found in the large intestine. Mostly in mixed infections. Worldwide.
- *Skrjabinema* spp. Found in large intestine. Worldwide.
- *Teladordsagia* spp. Commonly known as brown stomach worm. Found in stomach and small intestine. Number one worm problem in sheep and goats in regions with temperate climate. Mostly in mixed infections. It also occurs in the tropics in high altitude area.
- *Strongyloides* spp. Commonly known as threadworms or pinworms. Found in the small intestine. Mainly in warm and moist regions worldwide.
- *Trichostrongylus* spp. Commonly known as hairworms. Mostly in the small intestine in mixed infections. Worldwide.
- *Trichuris* spp. Whipworms. Found in the large intestine. Usually a secondary issue. Worldwide.

2.1.2 **Life cycle of nematodes**

The life cycles of these nematodes follow a similar pattern, with some exceptions (e.g., *Nematodirus spp.,* for which larval development occurs within the egg. Sexually dimorphic adults are present in the digestive tract, where fertilized females produce large numbers of eggs that are passed in the faeces. Strongylid eggs (70–150 μm) usually hatch within 1–2 days. After hatching, larvae feed on bacteria and undergo two moults to then develop to ensheathed third-stage larvae (L3s) in the environment (i.e., faeces or soil). The sheath (which represents the cuticular layer shed in the transition from the L2; L3 stage) protects the L3 stage from environmental conditions but prevents it from feeding. Infection of the host occurs by ingestion of L3s. During its passage through the stomach, the L3 stage loses its protective sheath and has a histotropic phase (tissue phase), depending on species, prior to its transition to the L4 and preadult stages. Under unfavorable conditions (usually at the end of the grazing season), the larvae undergo a period of arrested development, called hypobiosis (*Hemonchus contortus*). Hypobiotic larvae then resume their activity and development in the following wet season the case of *Hemonchus*.(Zajac. *et al*. 2006)

2.1.3 Resistance to antihelmintics

There is no doubt that for the sheep and goat industries at least, anthelmintic resistance is the greatest threat to continuing production throughout the tropics/subtropics. In the high rainfall regions of Africa, anthelmintic resistance has been detected in virtually every instance when it has been specifically investigated. In Kenya, resistance is widespread, particularly to the benzimidazoles, and there exists a major problem of poor quality drugs commanding a major share of the market (Wanyangu *et al*., 1996*)*. Recent surveys in South Africa show that around 90% of sheep farms have parasite strains resistant to compounds from at least one anthelmintic group and approximately 40% of farms now have to confront the problem of multiple anthelmintic resistance (van Wyk *et al*., 1997

The occurrence of anthelmintic resistance in gastrointestinal nematodes in sheep on a farm in Kabete, Kenya was investigated between October 2005 and March 2006 when an outbreak of acute and fatal helminthosis occurred despite the use of ivermectin in worm control. The efficacies of locally available anthelmintics, namely, ivermectin, levamisole, levamisole rafoxanide combination and albendazole were evaluated based on faecal egg count reduction percentages (clinical manifestation of helminthosis and post-mortem worm count . All drugs tested showed low efficacies with FECR% of 44.2%, 77.0%, 66.9% and 42.3% for ivermectin, levamisole, levamisole rafoxanide combination and albendazole respectively. *Hemonchus* *contortus* and *Trichuris ovis* were resistant to all drugs tested. *Trichostrongylus species* were resistant to ivermectin and levamisole, but susceptible to albendazole

(Gakuya *et al* 2007)

Also (Maingi *et al.* 1998) demonstrated that there were nematode resistant to levamisole and Albendazole in a farm in Nyandarua County.

2.1.4 **Occurrence of hemonchosis**

Haemonchus contortus is the most economically significant parasite of sheep and goats throughout much of the Kenya and the world, due to the severity of the parasitism and the emerging anthelmintic resistance.

2.2 **Economics**

In Kenya, *Hemonchos contortus* causes an annual loss of US$ 26 million in sheep and goats, while returns could be increased by as much as 470% by controlling the disease *(*Allonby 1975*;* Mukhebi *et al.1985).*

Helminth infections remain one of the major disease constraints to small ruminant production (FAO, 1992). Surveys indicate that up to 95% of sheep and goats are infected with helminths and that *Haemonchus* and *Trichostrongylus* are the main infecting species (Rey, 1991*).* However, the varieties of production systems found in the region affect the incidence and expression of helminth challenge.

The most striking effect of helminth infection in small ruminants is death of the host. Mortality rates may exceed 40% while weight loss of 0.6-1.2 kg/year/animal may occur (IEMVT, 1980). Insidious productivity losses through reduced feed intake and decreased feed utilization efficiency, associated with subclinical or chronic conditions, are often the largest economic losses (Holmes, 1993). These parasite nutrition interactions are exacerbated by the increasing pressure to cultivate marginal land, thereby further reducing available grazing for livestock. Under these conditions, the effects of poor nutrition and parasites are frequently linked and additive.

While the importance of helminthiasis is realized, few references convert the biological influence of parasitism into economic terms. In Kenya losses have been estimated at US $ 31 million annually (M. Upton, personal communication). Economic returns over cost of treatment with anthelmintics in small ruminants have been estimated at 215% compared to 32% due to supplementation and drenching (Ngategize *et al.,* 1990). Returns of up to 470% associated with control of *Hemonchosis* alone have been recorded *(*Mukhebi *et al.*, 1985). Data of this kind show that control of helminth infections in small ruminants in sub-Saharan Africa can be economically profitable.

In Kenya, *Hemonchosis* causes an annual loss of US$ 26 million in sheep and goats, while returns could be increased by as much as 470% by controlling the disease (Allonby 1975; Mukhebi *et al.*1985).

2.3 Treatment and control

2.3.1 Treatment

Treatment is mainly with antihelmintics and the following antihelmintics are used.

1 Macrocyclic lactones i.e, Ivermectin

2. Benzimidazole i.e, albendazole

3. Imidathiazoles i.e, Levamisole

4. Salicylanilides i.e, Rafoxanide, closantel

5. Tetrahydropyrimidines i.e, Pyrantel

6. Copper Oxide wires

The antihelmintics are sold as individual compounds or as a combination of different classes of antihemintics. However, there exists a major problem of poor quality drugs commanding a major share of the market (Wanyangu *et al*., 1996*)*

2.3.2 Control strategies

Potential methods available to control helminthiasis include the use of vaccines, grazing management,anthelmintics and exploitation of genetic resistance. Use of vaccines is not yet a viable option. Grazing management calls for greater understanding of the epidemiology of the parasite. This information, is however, not readily available to farmers in the vastly different agroclimatic zones of sub-Saharan Africa. It is also difficult to practise where the grazing resourc is limited and shared.

2.3.2.1 Pasture management and strategic deworming

These programs are strategic in nature and are based on treatment of sheep followed by movement to pastures of low infectivity. They depend on understanding the nematode epidemiology especially the weather pattern and the worm loads. However, these programs have problems being implemented in the tropics due to the hot humid weather that ensures continued development of nematodes throughout the year.

Pastures can be prepared as low contamination in a number of ways.

- By the pastures being ungrazed entirely.
- Being grazed by animals of another species with few or no parasites in common with sheep, usually cattle, but not goats.
- By being grazed by suppressively treated sheep.
- By being grazed by adult dry sheep which have strongly developed immune response and therefore low fecal egg counts.

Largely, the programs have been extremely successful, to the extent that ***H contortus*** may have been eradicated from some farms using WORMKILL in some parts of Austrailia.

2.3.2.2 The benefits of enhanced nutrition in parasitized ruminants

Several reviews have concluded that sheep offered a high plane of nutrition are better able to withstand the detrimental effects of nematode parasite infection than those less adequately nourished (Parkins and Holmes, 1989; Coop & Holmes, 1996; van Houtert & Sykes, 1996). It has been shown that an adequate supply of dietary protein enables infected sheep to withstand the pathophysiological consequences of infection through compensating for parasite-induced protein deficiency resulting from increased endogenous protein loss from the gastrointestinal tract. Improved dietary protein supply improves the capacity of infected sheep to mount an effective immunological response to infection and enhances the onset of parasite rejection (Steel *et al,* 1982*;* Abbott *et al,* 1988*;* Roberts and Adams, 1990*).*

Availability of protein aided parasite rejection as evidenced by lower faecal egg counts and lower total parasite counts at slaughter in those lambs receiving the infusion. *(* Coop *et al.* 1995*)*.

Unfortunately the provision of high quality protein is usually not an economic proposition for small ruminant producers due to high cost and is therefore not often practiced.

Recent research has indicated that provision of low cost supplements enhances the ability of infected hosts to overcome the detrimental effects of nematode parasitism. In controlled pen studies with young Merino sheep,*(* Knox *et al.* 1994)showed supplementation of a low quality roughage diet of oaten chaff and essential minerals with urea reduced the effects of parasitic infection by reducing fecal egg output and parasite burden and increasing weight gain and wool production. Further studies (M.R. Knox and J.W. Steel, unpublished*)* using a urea molasses blocks (UBM) supplement with a similar basal diet showed similar production responses to supplementation in parasitized young Merino sheep but not when feed intake restricted to that of the unsupplemented group.

There is no much difference in weight gain or mean fecal egg counts in cattle fed on UBM alone and UBM with fenbendazole at range normally recommended dose for continual low-dose delivery of Fenbendazole (0.5–0.75 mg/kg/day for cattle) which may indicate the early development of Benzimidazole resistance in this population of nematodes (Waruiru *et al.* 2003)

2.3.2.3 Sheep resilient/resistant to nematodes

The ability of animals to resist infections with parasites is genetically determined and therefore variable between individuals or breeds of a given host species. Such variation may involve innate (non-immunological) and acquired (immunologically mediated) resistance mechanisms, and is determined by both major histocompatibility complex (MHC)-linked and non-MHC genes. Resistance is inherited as a dominant trait, with heritability often exceeding 0.3. Genetic variation can be exploited to improve the capacity of domestic animals to resist parasitic infection.

A number of traits can be used to identify animals with increased resistance to infection. These include the concentration of nematode eggs in the faeces, the packed red blood cell volume, the extent of eosinophilia in the peripheral blood, the concentration of antiparasite antibodies, the concentration of fructosamine and the growth rate of the animal.

The Red Maasai in East Africa is not only more resistant to nematodes but is more productive under moderate to severe challenge with *H. contortus.*(Stear and Wakelin, 1998)

2.3.2.4 Predacious fungi

The predacious activities of a number of fungus species in the soil, compost and manure have been known for more than hundred years, but strangely enough, this knowledge was not utilized in the context of nematode control until much later and initially only in the control of parasitic nematodes of plants.

They are normally of three types fungus with nematocidal activity.

Nematode- trapping fungi. These fungi produce specialized hyphal trapping devices, such as adhesive networks, knobs, and constricting or non-constricting rings. Fungi in this class may also produce nematode hemoattractant and/or chemotoxic substances (Waller and Faedo, 1993). Within a short period of time following capture of the nematode, the fungus penetrates the worm and destroys it.

Endoparasitic fungi. These fungi invade the nematode from adhesive spores that stick on the cuticle, from spores that are ingested by the nematode, or from motile spores in water.

Ovicidal fungi. This attack the eggs

The fungi destroy the nematode in the sheep's intestines limits the buildup of severe pasture contamination in the late grazing season and subsequently limit the intake of larvae in sheep (Githigia *et al*,. 1997). There are varying possibilities and potential limitations with the use of *D. flagrans* under field conditions. Fungus feeding does not eliminate the risk of severe infection and can consequently only be applied on uninfected animals and clean pastures.

2.3.2.5 Immunity

Adult dry sheep have sufficiently strong immunity against most helminths to prevent clinical disease in the face of continued larval intake provided they do not suffer nutritional stress. They maintain generally stable low worm burdens and produce fewer worm eggs than younger sheep or reproducing ewes. Sheep do not, however, develop a significant immunity against infection with *Fasciola hepatica (*Meek *et al*, 1979).

The immune response is generally strong for *Nematodirus* spp and *Trichostrongylus* spp but more labile in the case of *Ostertagia* spp and *H contortus* (Anderson *et al.* 1978)

The effect of immunity is to prevent the continuing accumulation of worm burdens as a simple consequence of ingesting larvae. In the case of *Ostertagia* spp, the population is maintained by 'turnover', in which established adult worms are expelled and replaced by adults newly developed from ingested larvae. With *H contortus* the process of regulation is different. Once immunity develops, a certain number of adult worms reside in the gut and further.

2.3.2.6 Worm vaccines

For around the last three decades , much effort has been directed at the development of a vaccine especially against *Hemonchus contortus*, either based upon naturally exposed or hidden antigens (Smith, 1997). Despite promising results and mass appraisal over the years, a commercial product is still to be released. Dictol, based on infective *Dictyocaulus viviparous* larvae attenuated by irradiation, is the only marketed vaccine against GI nematodes but it has only a very limited distribution.

2.4 Diagnosis of nematodes in livestock

2.4.1 Clinical signs

The most common clinical signs are failure to thrive and weight loss. As worm burdens increase, more severe signs, such as anemia, hypoproteinemia, submandibular edema (bottle jaw), weakness, and collapse, may develop. Unlike other gastrointestinal nematodes, *H. contortus* does not usually cause diarrhea. Due to the nonspecific signs and lack of diarrhea it may not be easy to make a diagnosis. (vanWyk *et al* 2002)

2.4.2 Clinical pathology

Clinical pathology findings include anemia, hypoproteinemia, and eosinophilia. In one experimental study, mean packed cell volume dropped to 15% in infected sheep 35 days after infection, and mean eosinophil count increased from <5% to 25% of circulating white blood cells 56 days after experimental infection. Eosinophilia decreased from days 63-77 of the experiment, which may have resulted from localization of eosinophils to the abomasum. A significant correlation between eosinophilia and worm burden has been demonstrated. (Yacob *et al* 2009*).*

2.4.3 The FAMACHA system

The FAMACHA system uses a 5-point scale to gauge ocular mucous membrane color, which correlates with packed cell volume in sheep. Owners and veterinarians must be trained in the system and use the official cards, but the FAMACHA system is practical on-farm, and can be used to select animals for strategic de-worming. The FAMACHA system also has been successfully used in goats and camelids. The importance of regular application of FAMACHA scoring cannot be over-emphasized. (vanWyk *et al* 2002)

2.4.4 Fecal floatation and McMaster's technique

Although fecal flotation is a valuable diagnostic tool to assess gastrointestinal parasitism, *H. contortus* eggs cannot be distinguished easily from those of other strongylids. The McMaster's technique is easily learned by veterinarians and producers, and can also be used to assess anthelmintic effectiveness by measuring the reduction in fecal egg count 7-14 days after deworming.

Most sheep with clinical Hemonchosis have high fecal egg counts, up to 10,000 eggs per gram. However, the prepatent period for *H. contortus* is 15-21 days in sheep, and peracute infections can result in death before eggs are present in the feces.

2.4.5 Larval culture

Parasitology laboratories can culture larvae from parasite eggs to speciate the nematode; however, larval culture usually takes 10-14 days. Some laboratories perform *in vitro* analysis of anthelmintic resistance by exposing hatched larvae to various anthelmintic drugs.

2.4.6 Postmortem diagnosis

Gross lesions and the presence of characteristic nematodes in the abomasum often provide a diagnosis at necropsy. Animals with Hemonchosis have marked pallor of mucous membranes and internal tissues. A characteristic gross lesion is widespread subcutaneous edema. This may be most striking in submandibular soft tissues, producing the so-called "bottle-jaw". Edema is concentrated in the submandibular soft tissues because the head is often dependent in grazing animals. Hydrothorax, hydropericardium, and ascites are other sequelae of hypoproteinemia as is edema of the abomasal mucosa. Lymph nodes draining the abomasum may double in weight within five days of infection.

The abomasum has dark red-brown contents with multifocal mucosal hemorrhages and *H. contortus* adults. In a freshly dead animal, the worms are often alive and writhing; if the animal has been recently treated with anthelmintics, worms may not be found. The adult worm is approximately 2 cm long; the female has a characteristic "barber-pole" appearance due to the red color of the blood-filled digestive tract against the white reproductive tract. The male is all red and slightly shorter. Both worms have a buccal tooth that can pierce the abomasal mucosa to suck blood.

Common histologic lesions, such as interstitial edema in many organs and centrilobular hepatic necrosis, are sequelae of the hypoproteinemia, anemia, and resultant hypoxia (Balic *et al.*2000). Abomasitis may be seen with increased numbers of mucosal lymphocytes, eosinophils, and mast cells.

CHAPTER THREE MATERIALS AND METHODS

3.1 Study area

The study was carried out at the University veterinary farm located at approx 0.5 km from The College of Agriculture and Veterinary Sciences in Kambu County. The farm is 20 kilometers from the capital City of Kenya, Nairobi, to the west. The farm is about 375 acres in size with a cool wet climate receiving an annual rainfall of about 700 mm to 2000 mm thus the area has high potential for sheep farming.

The farm deals with the rearing of dairy animals, pigs, poultry, goats and sheep.

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3.2 Target population

My target population was sheep. These were mainly females of the Dorper breed which were mainly adults. There were few weaners and males.

3.3 Sample collection methods

Data was collected using semi-structured in depth interviews with herdsmen and observation of sheep general management and the grazing systems. Fecal samples were taken from the rectum individual sheep randomly for laboratory analysis.

3.4 Retrospective survey of nematodes in the farm

The results found after analyses of data were compared with similar data done by Nabi oki in January 2013.

3.5 Farm records

The deworming history was checked for the last three years. In each time the date of antihelmintic administration and the antihemintic type used were recorded.

3.6 Fecal sample analysis

The samples were analyzed with the MacMaster technique. Positive samples were cultured as described by Maff (1986)

CHAPTER FOUR RESULTS

Nematodes were not the only parasites found in the fecal samples of sheep in Kanyariri Farm, there were also coccidial oocysts in the feces of the sheep.

4.1 The grazing system and antihemintic regimes

The farm practiced rotational grazing and routine deworming of the animals of the sheep at a 3 to 4 months interval with Closantel and Ivermectin.

4.2 The difference in egg count in 2013 and 2015

This study had done on 29thJanuary2013 at a Vet farm in Kabete and a similar study in 23rdMarch2015

Table 1 A table showing the level of infestation in March 2015 and January 2013

Year	Mean fecal egg count
2015	339
2013	2350

There was a significant difference in the level of infestation between the two years.

The sheep were dewormed in after every four months with Closamectin and were last dewormed with on 24th January 2015.The records of previous years were poorly kept.

4.3 Nematode infestation by age

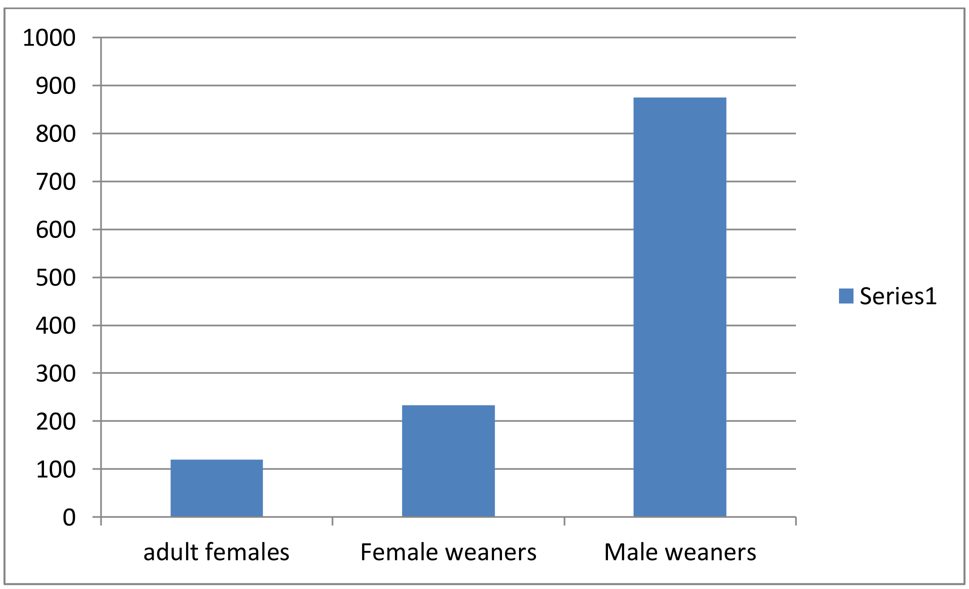
From the samples analyzed nematode eggs and coccidian oocysts were found in the sheep. There were no animals that were clinically ill at the time of study. The result indicated that female adult sheep were the least affected by the nematodes with an average 120 eggs per gram of feces.

Sheep with ear tag number 209 which was pregnant almost lambing had, 900 eggs per gram of feces, the largest egg cont among the females. The prevalence in the adult females was 40%.

The female weaners had an average egg count 233. This was significantly higher than mean fecal egg counts than female adults. All the sampled were positive for coccidia and nematodes.

The male weaners who were confined in fattening pen inside the sheep boma and were being fed on concentrate meal had a mean fecal egg count of 875. All were positive for coccidia and neamatode eggs

Figure 1 The average fecal strongyle egg count of age groups

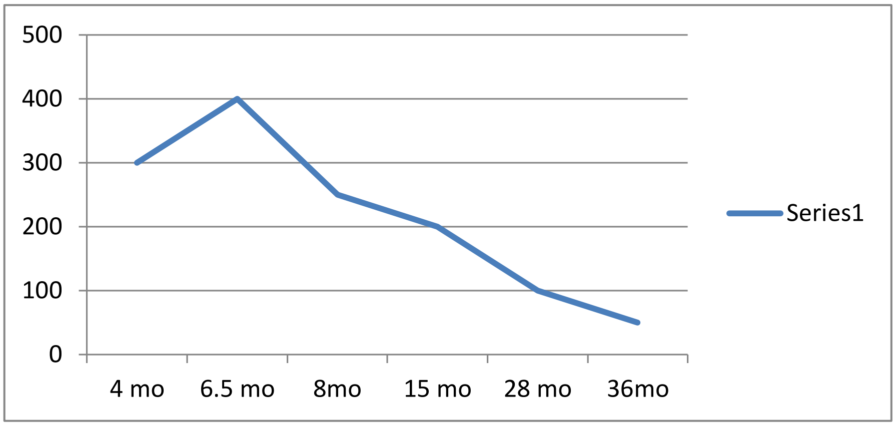


4.4 Variation of coccidial oocyst counts with age

The coccidial oocyst counts were higher in the weaners with a mean of ++ compared with adults + or O. There was decrease in the coccidal oocyst counts as the age of the animal increased

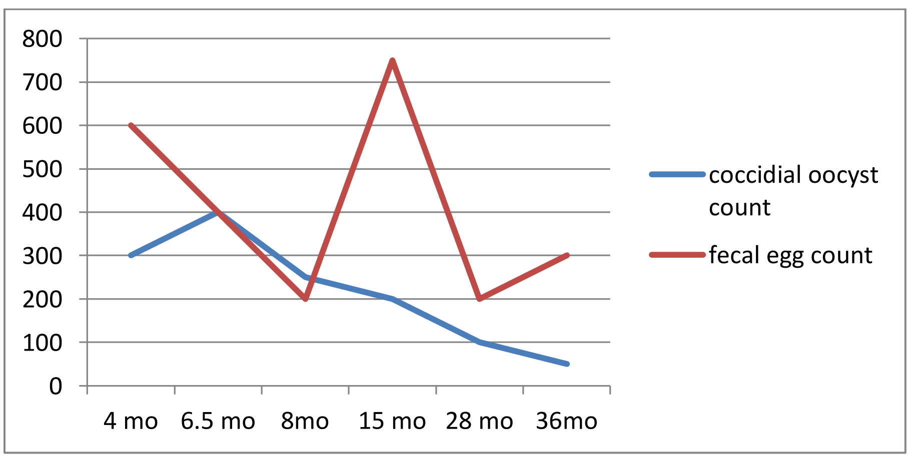
Figure 2 A graph showing coccidial intensity with age

The coccidial oocysts counts decreased with the increase in age of the sheep.



4.5 The egg count distribution with age and its correlation coccidial oocyst count

Figure 3: A graph showing fecal coccidia and nematode egg counts and correlation with sheep age.



The coccidial oocyst counts were independent of nematode egg counts as age changed.

4.6 Results on culture

Tricostronglus species were the most prevalent nematodes in the farm at 78. 7% followed by *Oesophagostomun species* at 14.2% and lastly *Hemonchus species* at 7.1%

CHAPTER FIVE: DISCUSSION, CONCLUSION AND RECOMMENDATION

5.1 Discussion

The objective of the study was determine the level of infestation and level of infestation found in sheep of Kanyariri Veterinary Farm and the effectiveness of the control strategies. In my research I found the level of infestation was low at 339 eggs per gram for the infested and a prevalence of 38%. This may be due to the rotational grazing which prevents build up large numbers of infective L3 and the good choice of antihelmintic. Though it was a dry season there was a very insignificant infection in the sheep that could not be attributed to hybobiosis. Also the postmortem of sheep from the farm did not show nematode infestation. This was also significant because in a study done by Nabi oki in the same farm on January 2013 indicated an average of 2350 eggs per gram which was also a dry period as it was in my case.

There was no correlation between the coccidial oocyst counts and nematode fecal egg counts. The oocyst counts reduced with the increasing age while the strongyle egg counts varied with different age groups. This phenomenon can be attributed to a stronger immunity acquired against coccidia parasites while the immunity acquired against helminthes varied with host factors such as stress due to factors like pregnancy, since the adults that had higher FEC were pregnant sheep in the periparturient period. This result agree with (Erin E. Gorsich *et al* 2014).

There was a significant difference in weaners who were male and were being fed on a different diet in the farm and were confined from the rest of the herd. These weaners were being fattened with hay and concentrate meal before they were sold. They looked healthy but the egg count per gram was twice as much as the herd average. This could have been due to the release of the arrested l4 which could have been due to the favorable gut environment brought by the better nutrition and ample supply of water or contaminated handling pen.

Closamectin has shown superiority in control of hemonchosis. Closamectin is a drug marketed by Norbrook limited. It contains Ivermectin a macrocyclic lactone which is broad spectrum and closantel which is a sacyclalinide which is narrow spectrum and has excellent results against *Hemonchus contotus* (Waruiru. *et al*.1998). After oral administration closantel is readily absorbed into the bloodstream. Four days after treatment up to 60% of the injected and 30% of the drenched closantel is absorbed to blood. In the blood, unchanged closantel binds strongly and almost completely (>99%) to plasma albumins. Peak plasma levels are reached 10 to 48 hours after administration, both after oral or intramuscular administration. Half-life in plasma is 3 to 4 weeks. closantel has a residual effect, i.e. it not only kills the parasites present in the host at the time of treatment, but protects against re-infestation for a period of time that depends on the dose and the specific parasite(Parasitepedia.net)

There was one red Maasai sheep in the herd and the sheep had the no eggs in her fecal sample. However due to the low number of the red Maasai sheep the data could not statistically show a significant difference in the level of infestation. This was coupled with the fact that some Dorper sheep fecal sample also tested negative.

Due to the low numbers of male sheep in the farm, who were on a deferent diet I could not determine whether the increase in the egg counts were due sex

5.2 Conclusion

- The result of this project supports the null hypothesis which says "Nematode infestation in Kanyariri University Farm is prevalent and control strategies applied are effective".

- There was no relationship between coccidial oocyst count and stronygle egg count as the age of the sheep changed.

5.3 **Recommendation**

Areas of further development.

- So in my recommendation to people conducting such study in future should have Male and females on the same diet to show whether difference exists due to the sex of the animal.
- Also I will recommend improvement of my research by having same number of Red Maasai sheep breed as the Dorper sheep breed to show how the difference in the mean egg count per gram of the two breeds.
- This research can also be improved by checking the exact cause of the increase of fecal egg count in the fattening pen.

Recommendation to the farm.

- To provide lambing pens for animals in the periperturient period to avoid pasture contamination and deworm the ewes before they can join the rest of the flock.
- Provide larger pens and hold few animals in the confinement pens to avoid excessive contamination of the pens.
- To deworm the sheep before at the start of the rainy season in April to prevent build up severe pasture contamination in the rainy season.

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