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COLLEGE OF AGRICULTURE AND VETERINARY SCIENCES

FACULTY OF VETERINARY MEDICINE

A STUDY ON PREVALENCE OF CAMEL GASTROINTESTINAL PARASITES IN ATHIRIVER ABATTOIR

INVESTIGATOR;

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A PROJECT SUBMITTED IN PARTIAL FULFILMENT FOR THE DEGREE OF BACHELOR OF VETERINARY MEDICINE IN THE UNIVERSITY OF NAIROBI

DECLARATION

I do declare that this project has not been submitted for any award at any other institution of higher learning.

Signature _____ Date _____

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This project report is submitted for examination with our approval as the university supervisors

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ABSTRACT

Camel is an even-toed ungulate belonging the genus camelidae which has two species namely *Dromedary* and *Bactrian*. *Dromedary* camels are found in Middle East and Horn of Africa Regions while *Bactrian* camels inhabits mainly Central Asia.

The current world population of camels is 28 million with an increasing trend observed for the last few decades. Kenya's camel population is 3.64 million with majority of the camels kept in the arid and semi arid areas of Northern part of the country.

A cross section study was conducted in Athi River, Machakos county. A total of two hundred and fifty three camels meant for slaughter sampled. Faecal material was collected and analyzed for the presence of helminthes using McMaster faecal egg count technique.

A total of 230 (90.9%) samples were found to be positive for *Strongyle* eggs, 38 (15.0%) positive for *Strongyloid* eggs, 3(1.2%) positive for *Coccidial occysts,* 1(0.39%) positive for tape worm segments. Only 23 (9.1%) samples were found to be negative for any parasite. Culturing of faecal samples was done and larvae of different helminths were identified. For the *Nematodes* three genera were identified, namely; *Hemonchus* (20%), *Trichostronglus* (62.14%) and *Ostatagia* (17.86%).

Five (5) different types of gastrointestinal parasites were found to be infecting the camels examined. Mixed infection with more than one genus of helminths was also observed.

Owing to the economic and public health significance of the parasites found in this study, enlightenment of the camel owners to institute helminths control measure like deworming should be done. In addition further quantitative studies should be done to understand the magnitude of the problem in the country.

CHAPTER ONE

1.0 INTRODUCTION

1.1 BACKGROUND INFORMATION

The camel is an even-toed ungulate belonging to the *genus Camelus,* bearing distinctive fatty deposits " humps" on its back. One major feature that differentiates them from other members of their order is that they have soft-padded feet. (Mahmud A. *et. al.*, 2014). The two species under the genus *Camelus* are the *dromedary* (one humped) mostly inhabits Middle East and horn of Africa and the *Bactrian* (two humped) which inhabits central Asia.

Currently the camel population in the world is estimated to be 13 million, while in Kenya most camels are concentrated around the arid and semi-arid areas (ASAL) with a population of 3.64 million (Kuria *et. al.*, 2009). In Kenya ASAL areas covers 83% of the land mass and is home to over 12 million of the country's population, mainly composed of the pastoralists i.e. the Somali, Rendile, Samburu, Gabra, Turkana, and Kalenjin (Issack M. *et. al.*, 2013).

The camel is well adapted to harsh climatic conditions and due to this it forms a sustainable livelihood for the pastoral communities by providing the following: Production of meat, milk, labour, means of transport and as a genetic resource base which is much available that can be exploited for livelihoods of pastoral communities (Schwartz and Walsh., 1992). The current rapid human population growth, increased levels of urbanization, coupled with the current low economic status of the counties have negatively impacted on the camel.

Camels are best adapted to the harsh environments and fluctuating nutritional conditions of the arid and extremely arid zones and therefore providing reliable source milk in contrast to goats and cattle (Schwartz H. *et. al.* 1983).

The major challenges in pastoral livestock production including camels are feeding, health and housing. The increased incidence of diseases is one of the limitations associated with camel

production (Swai E. *et. al.* 2011). Gastrointestinal parasites like *Trematodes*, *Cestodes* and *Nematodes* are generally known to contribute to loss of reproductive and productive performance in camels (Schmindz., 1989).

The main clinical signs of parasitic gastroenteritis include severe diarrhoea, stomach pain, weight loss, reduce production rate, decreased feed intake, increased veterinary cost and subsequent death in severe cases. Animals in pain and discomfort are less productive than their healthy counterpart. Some parasites have zoonotic implications to those who work closely with camels (Mahmuda A. *et. al.*, 2014). Studies have shown that climate, management system, poor husbandry and under feeding have an influence on occurrence and pattern of infection among camel populations. Presence of various helminths species with high prevalence is an indication of favourable environmental condition for infection, survival and perpetuation of parasite existence in camel (Swai E. *et. al.*, 2011).

1.2 PROBLEM STATEMENT

Both ectoparasites and endoparasites pose a big challenge to camel production in Kenya, with majority of the camel keepers not deworming their camels regularly as compared to other livestock. This situation is further aggravated by lack of concrete research on the helminths burden in Kenya.

In addition, the zoonotic aspect of the gastrointestinal parasites in camels is of great public health significance (Allen *et. al.*, 1992).

The need for an extensive study on camel gastrointestinal parasites is important putting into consideration the economic importance of camel meat production.

1.3 OBJECTIVE OF THE STUDY

1.3.1 General objective

To determine the prevalence of gastrointestinal parasites in Kenyan camels

1.3.2 Specific Objectives

1. To determine the prevalence of gastrointestinal helminths in camels slaughtered in Athi-River, Machakos County.
2. To identify the risk factors associated with the prevalence of GIT helminths in camels slaughtered in Athi-River abattoir.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 CAMEL HELMINTHOSIS

2.1.1 Introduction

Despite the general reputation for hardness and resilience, camels are vulnerable to many infectious conditions including parasites (Wernery *et. al.,* 2004.). Helminths are known to cause damage to the host by use of multiple mechanisms: Suppression of food intake level, loss of production, poor feed conversion ratio and even diarrhoea. It is usually manifested as a subclinical condition or asymptomatic. (Borji *et. al.,* 2010).

2.1.2 Susceptibility in terms of breed and sex

The prevalence of gastrointestinal parasite infections is observed to be high in young camels of three years or less and low in camels of six years or above. The high susceptibility of the young camels to helminths could be suggesting a possibility of early exposure of camel calves to the grazing area(s) and subsequent greater larval intake. Other studies carried out in other regions show similarities and differences, which could be due to geographical location, time period and variation in methods of sample analysis or even camel management practices.(Mahmuda *et. al.,* 2014).

2.1.3 Aetiology and contributory factors.

Eleven different species of gastrointestinal worms usually affects camels namely: Nine species of *Nematodes*, one *Trematode* and one *Protozoan* species.

The most common Nematodes affecting the camels are: *Haemonchus longistipes*, *Trichuris spp.*, *Camelostrongylus mentulatus, Trichostrongylus spp., Nematodirus spp.,* and *Haemonchus contortus*. Extra-intestinal helminths such as *Onchocerca fasciata*, cysts of *Echinococcus granulosus* and *Dictyocaulus cameli* have also been documented. (Banaja A. and Ghandour A., 1994).

Strongylus and *Trichostrongylus* are the most common helminths. Others like *Eimeria* species are at low frequency.

The high prevalence of the *Strongylus* can be attributed to the long pre-patent period of *Strongyle* eggs, nature of agro-ecological environment, poor hygiene, lack of veterinary service in remote pastoral areas. The greatest numbers of larvae are on blades of the grass in the early morning and late evening when temperature, humidity and light intensity are favourable. In this regard knowing that Camels are grassed late in the evening when light intensity and moisture are favourable, then there is high chances of camels picking the infective larvae. (Soulsby. *et. al.,* 1965).

Parascaris species prevalence is low in camel compared to *Strogylus*, this could be because *Parascaris* eggs are very resistant to adverse conditions like drying or freezing and therefore the larvae rarely hatch. (Swai E. *et. al.,* 2011). Since infection is via ingestion, heavy infestation of *Parascaris* may lead to impaction or perforation resulting to peritonitis. *Anaplocephala* species prevalence are also said to be low in the camel because of sporadic discharge of gravid segment in the faeces and challenges in identification of *Cestodes* eggs by routine faecal examination.

The prevalence of *Eimeria* species infestation in camel is low but in the event there is heavy infestation, this may have great impact on young camels leading to a high level of morbidity and mortality. The prevalence of *E. cameli* increases during autumn and spring. This is attributed to a high level of humidity during these seasons.

Since the condition is subclinical animals appear fairly good even when infested with helminths. The body conditions of the camel does not show any significant indication of prevalence of the worm, but can be elaborated through presences of other diseases like *Trypanosomosis* or in case of seasonal changes (drought). (Swai E. *et. al.,* 2011). The camel can also act as intermediate host to other parasites like *Longuatula serrata* that inhabits respiratory system of dog that is the definitive host.

Sex of the animal could also play a critical place in influencing prevalence of gastrointestinal infection.

Table 1 Predilection sites of different adult helminths parasites. (Borji et. al., 2010)

Abomasum	**Small intestine.**	**Large intestine.**
Camelostrongylus mentulatus	*Trichostrongylus probolurus*	*Trichuris globulosa*
Haemonchus longistipes	*Trichostrongylus vitrinus*	*Trichuris barbetonensis*
Parabromema skrjabini	*Trichostrongylus colubriformis*	
Marshallagia marshalli	*Nematodirella dromedarii*	
Teladorsagia circumcincta	*Nematodirella cameli*	
	Nematodirus oiratianus	
	Coperia oncophora	
	Cestodes	
	Stilesia globipunctata	
	Moniezia expansa	
	Moniezia benedeni	

A surge in helminths infestation can be attributed to a number of factors, among these are: Number of adult worms established in the intestine, host immunity level, stage of parasitism, poor animal health management and failure to adopt current animal health care Other factors influencing prevalence of gastrointestinal parasite eggs are like sex of the host where female seem to harbour more parasites than male counterpart, geographical location, usage of antihelmitics where those herds which antihelmitics are administered show lower level of parasite infestation, camels of less than three years seem to be harbouring more parasite than those that are more than six years.

Female camels are more infected by helminths than male counterpart. This finding could be attributed to the dynamics female life cycle and physiological peculiarities of female mainly comprising stressful periods and therefore having impact on their immunity level.(Swai *et. al.,* 2011).

2.1.4. Transmission

Camels get infected by helminths by ingestion of eggs harbouring the larvae or ingestion of effective larvae while grazing in the field. The gastrointestinal tract environment then facilitates the eggs to hatch into larvae and then it matures to lay eggs which are discharged through faeces and collected by camels as they graze.

in some parasites like *Linguatula serrata*, a tongue shaped parasite, lightly convex dorsally and flattened ventrally inhabits the respiratory system of canines which are its definitive hosts. Eggs containing larvae are discharged into the environment by nasopharyngeal secretions and are picked by grazing Camels including in which the infective nymphal stage develops in mainly mesenteric lymph nodes sometimes in other liver and lungs. In the intermediate host (herbivores) larvae and nymph infections is mainly asymptomatic. (Mohammad H. *et. al.,* 2010).

2.1.5 Distribution

Camel helminths have been reported worldwide where camels are found but specific reports have been given in the following countries: Lebanon, Turkey, Sudan, Tanzania, Iran, Nigeria, Saudi Arabia and Kenya**.**

2.1.6 Public health and economic significance

Haemonchus longistipes is the most pathogenic *strongyle* that is attributed to causing clinical diseases in camel. *Trichostrongylus* infestation may lead to wasting and debilitating effects. The effect is secretion of abundant mucus from gastric cells, mucosal flattening, atrophy of villous, haemorrhages and cellular eosinophilic infiltration. This damage leads to reduced intestinal absorption and decreased in production potential.(Burji *et.al.,* 2010). Consumption of *Linguatula serrata* nymphs in infected raw liver or lymph nodes of herbivores can cause a condition called halzoun syndrome in man. This condition manifests as inflammation of upper respiratory tract, swelling of sub maxillary and cervical lymph nodes and occasionally abscesses on the ears and eyes. Also reported in Iran is *Linguatulosis* with clinical signs of nasopharyngeal symptoms like sneezing, coughing and nasal discharges. As the animal ages the infection rate of *linguatulosis* increases. This phenomena can be attributed to increased re-infection rate and long term reduced host immunity level (Sajjadi *et. al.* 1998).

2.1.7 Diagnosis

2.1.7.1 McMaster Egg Count.

McMaster parasitological laboratory examination is majorly used to determine worm burden of the camels in various studies that have been carried out.

2.1.7.2 Culture

Culturing of faecal samples collected usually done to identify the infective larval stage of various helminths.

Figure 1: Infective larvae of Haemonchus, Ostertagia and Trichostrongylus Worms.

The cuticular morphology helps to differentiate the various infective larvae. Haemonchus larvae has narrow head with rounded tip, intestinal gut cells of 32 in number, blunt tail and medium length shealth. Ostertagia has broad head, blunt tail and short length shealth while Trichostrongylus has tapered head, 32 intestinal gut cells, almost blunt tail and short shealth.

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1. STUDY SITE

The study was carried out in Athi River abattoir in Machakos. This is the only abattoir supplying camel meat to Nairobi County. Camel slaughtered at the abattoir are sourced from various places including; Moyale, Isiolo, Marsabit, Bangale, Pokot, Marigat amongst other areas.

3.2. STUDY DESIGN

In conducting the study, a cross-sectional design was used. Data on sex, age, and source and traders identity was collected from each camel. To determine the level of worm burden/infestation. Faecal material was collected by Using a sample collection bottle fresh faecal sample was collected from the rectum of Camels, sealed and transported in cool box container before it is delivered to the laboratory and processed within 48 hours.

3.3. SAMPLE SIZE

253 samples were collected from a herd of three hundred camels using random sampling frame.

3.4 FAECAL SAMPLE COLLECTION

Sampling entailed random picking camels of various ages, colour, size, origin and all sexes, restraining in sitting position or standing using ropes and putting probe through the rectum to collect faeces in rectum.

Figure 2: A photo showing camel herd in boma' in Athi River holding ground

Figure 3: A photos showing faecal sample collection and laboratory processing

Figure 4: Faecal sample gross exam

3.5 FAECAL SAMPLE ASSESMENT

3.5.1 Gross examination

Gross examination of the faeces was done to check the consistency, colour, smell and presences of tapeworm segments if any.

3.5.2 Mc Master Worm Egg count

A known weight of faeces is mixed with a known volume of a floatation fluid. a sample of the mixture is placed in a counting chamber of known volume and all eggs are counted. Arithmetic conversion of the number of eggs yields the number of eggs per gram (e.p.g). of faeces.

Procedure

1. Fill the vial to the lower line with saturated magnesium sulphate salt 28ml.
2. Finish filling the vial to its upper graduation with faeces (2 grams by displacement).
3. Mix thoroughly
4. While still mixing remove a dropper full of the mixture and quickly fill the counting chamber. Note both sides not be filled from the same dropper.
5. Let it stand for few minutes to allow the eggs to rise to the top slide.
6. Place chamber under low power (x100) of the microscope and count eggs in the CM2 of the slide. Focus under top slide.
7. Multiply the count obtained for CM2 by 100 to get eggs per gram of faeces.

3.5.3 Faecal Sample Culture

Faecal samples are transferred from faecal sample collection tube into a flat plate on a table and been pallets then broken into fine particles (commuted). Tap water is then added to make it wet and irrigated. The commuted sample is then packed in small container and incubator at a temperature of 37 degrees for 7 days. The sample container is then removed from the incubator and placed on a table. Using a dropper tap water is sprinkled along the upper margin of the sample while holding the sample container in tilting position. After ensuring passage of water along the empty space over the sample, the water in mixture is then poured into small sample container. Using a dropper the mixture is swilled and a drop of is taken and placed on McMaster slide. The slide is then viewed in *10 electron microscope. The larval stage of the worms identified and accounted. Percentage number given depending on the number obtained.

3.4 DATA HANDLING AND ANALYSIS

Data entry was done using various methods:

- A database was created in Windows MS Excel where data from both laboratory and questionnaire was entered in separate spreadsheets.
- Data was then exported to STATA^{R} 9.1 for further analysis that included;

Descriptive statistics (means, frequencies, proportions, charts and graphs) was carried out for the laboratory and questionnaire data.

CHAPTER FOUR

4.0 RESULTS

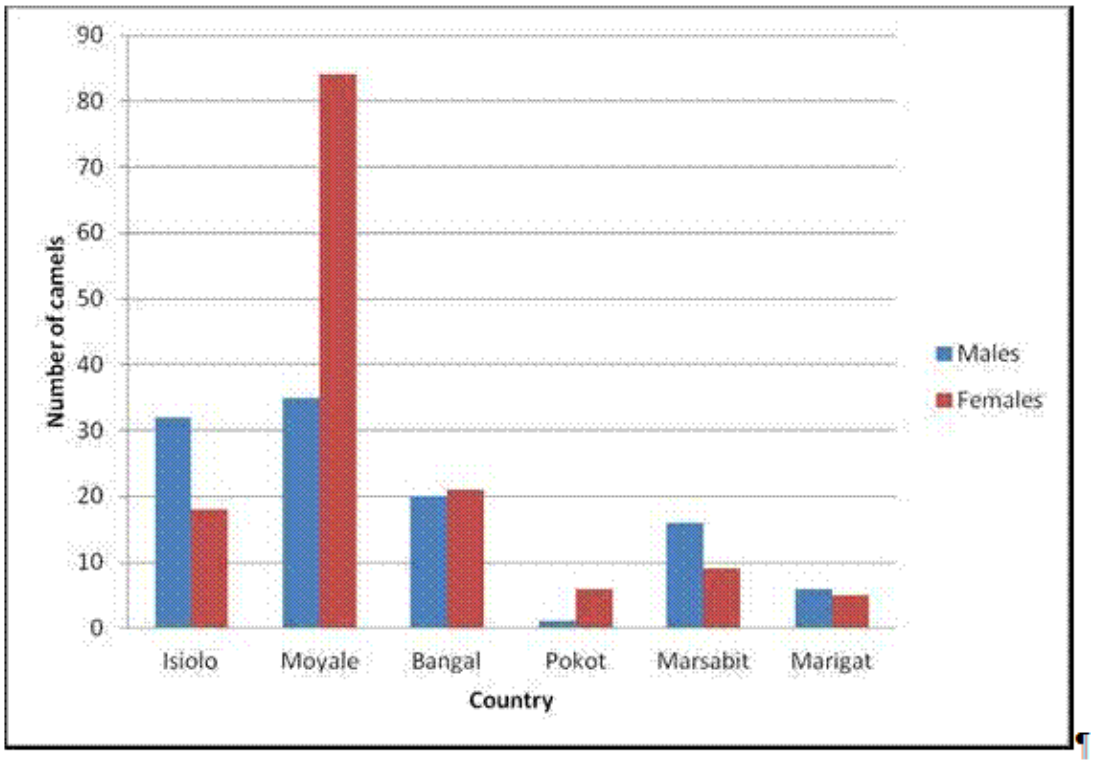
4.1 DEMOGRAPHICS

Most (47%; 119/253)of the camels sampled were from Moyale County, 19.76%(50/253) from Isiolo, 16.20% (41/253) from Bangal, 9.88%(25/253) from Marsabit, 4.34%(11/253) from Marigat and 2.77% from Pokot. In terms of gender the female camels tend to be greater in number 56.5%(143/253) than male counterparts (Table 2; Figure 4). Also clear in the table below is Isiolo, Moyale, Bangal and Marsabit counties of Kenya form the major source of camels for Athi River abattoir.

Table 2: Showing number sampled against gender of camels

County	**Males**		**Females**		**Total**	
	No	**%**	**No**	**%**	**No**	**%**
Isiolo	32	64	18	36	50	19.76
Moyale	35	29.41	84	70.59	119	47.03
Bangal	20	48.78	21	51.12	41	16.20
Pokot	1	14.28	6	85.71	7	2.77
Marsabit	16	64	9	36	25	9.88
Marigat	6	54.54	5	45.45	11	4.34
TOTAL	**110**		**143**		**253**	**100**

Figure 4: Graph showing gender distribution of sampled camels



4.2 PREVALENCE OF GASTROINTESTINAL HELMINTHES IN CAMELS SLAUGHTERED IN ATHI-RIVER MUNICIPAL ABATTOIR, MACHAKOS COUNTY

Ninety percent (230/253) of the camel faecal samples examined by floatation technique were positive for at least one infection with helminths, *Coccidia* and/or tapeworm. Three different types of helminths were identified with the Nematode, *Trichostrongylus species* (62.14%) showing the highest prevalence among all other species found. The other genera found are shown on Table 3.

Table 3: Overall percentage prevalence of parasites found in camels slaughtered at Athi River Abattoir, Machakos county, Kenya.

Identified Parasite	Prevalence %
Haemonchus species	18.4
Ostertagia species	17.86
Coccidia oocysts	1.2
Trichostrongylus species	62.14
Tapeworm segments	0.39

4.3 CULTURING OF THE FAECAL SAMPLE WAS DONE TO IDENTIFY SPECIFIC WORM LARVAE

Cuticular morphology i.e. shape of the head, oesophagus, number of intestinal gut cells, tail shape and length of the shealth was used to differentiate the various infective larvae. For *Haemonchus* larvae the head was narrow and rounded tip, intestinal gut cells of 32, blunt tail and medium length shealth. *Trichostrongylus* larvae had tapered head and short shealth while that of *Ostertagia* the head looked broad and shealth was long. Culture result indicated high count of infective larvae of *Trichostrongylus*, *Haemonchus* and *Ostertagia* species with 62%, 18% and 17% respectively (Table 5.)

With respect to level of infection, camels from all the counties sampled show significant level of severely infected number, with Moyale, Bangal, Marsabit and Isiolo scoring greater percentage (Figure 5).

Table 4: A table showing level of infection against county

County	Severe	Moderate	Mild	None	TOTALS
Isiolo	17	8	3	22	50
Moyale	63	16	11	29	119
Bangal	22	8	8	3	41
Pokot	4	0	0	3	7
Marsabit	14	5	4	2	25
Marigat	5	2	3	1	11

Figure 5: Graph showing level of infection against county

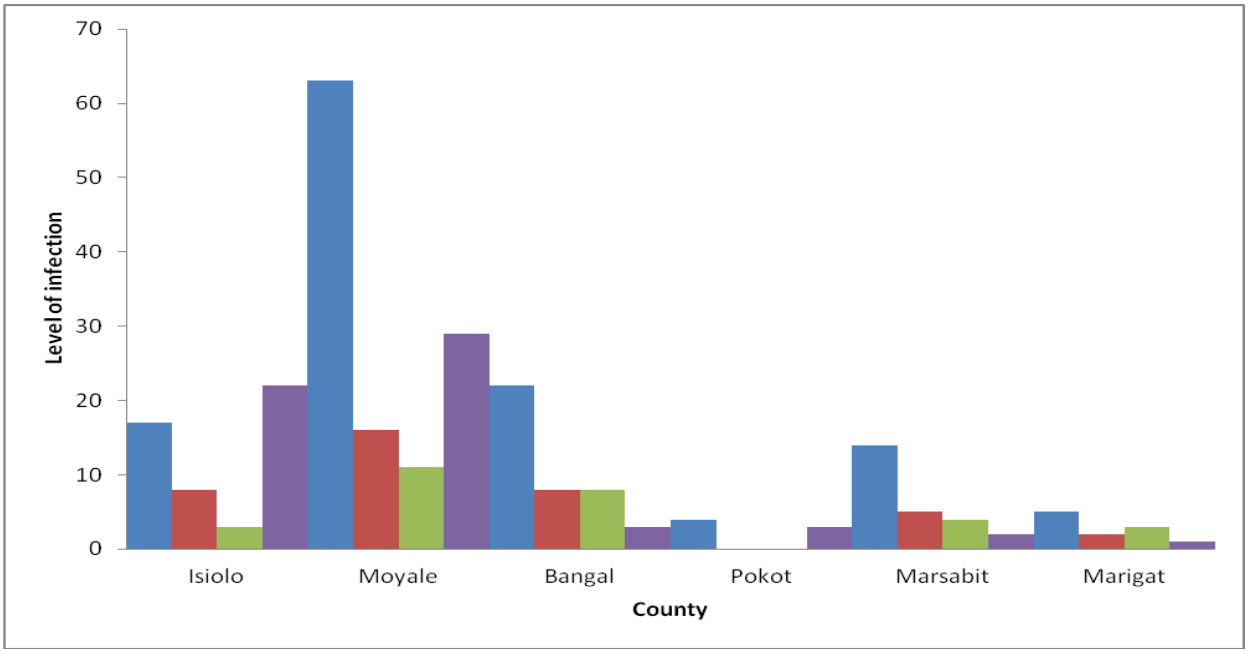


Table 5: Showing level of infection against gender and county of origin

County	**Level of infection**								
	3		2		1		0		TOTALS
	Males	Females	Males	Females	Males	Females	Males	Females	
Isiolo	14	3	6	2	2	1	10	12	50
Moyale	18	45	6	10	3	8	8	21	119
Bangal	10	12	2	6	7	1	1	2	41
Pokot	1	3	0	0	0	0	0	3	7
Marsabit	9	5	2	3	4	0	1	1	25
Marigat	4	1	1	1	1	2	0	1	11
TOTAL	**56**	**69**	**17**	**22**	**17**	**12**	**20**	**40**	**253**

Basing on county of origin the table above points out severe level of infection in both male and female camels from Isiolo, Bangal, Marsabit and Moyale.

Figure 6: Graph showing level of infection against gender and county of origin

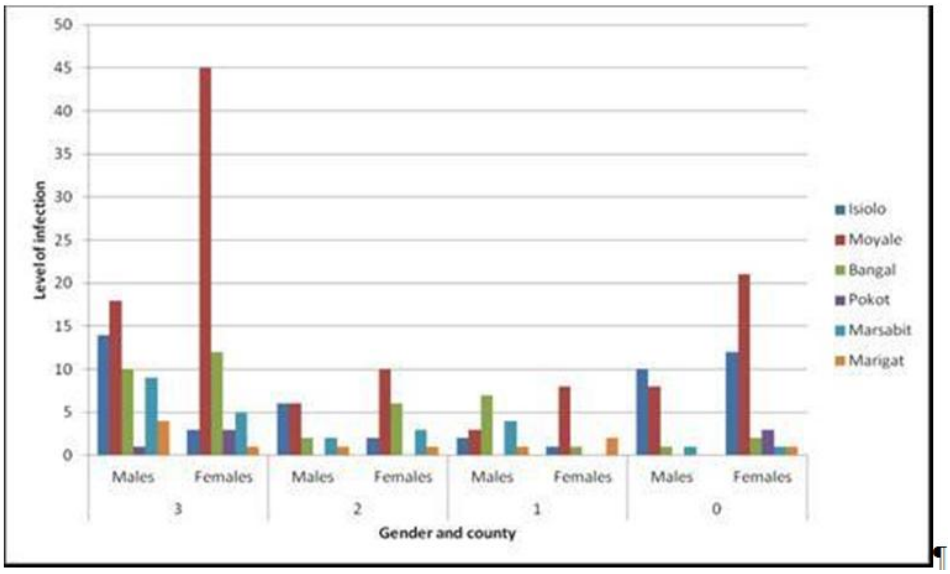


Figure 7: Graph showing the duration of holding and level of infection

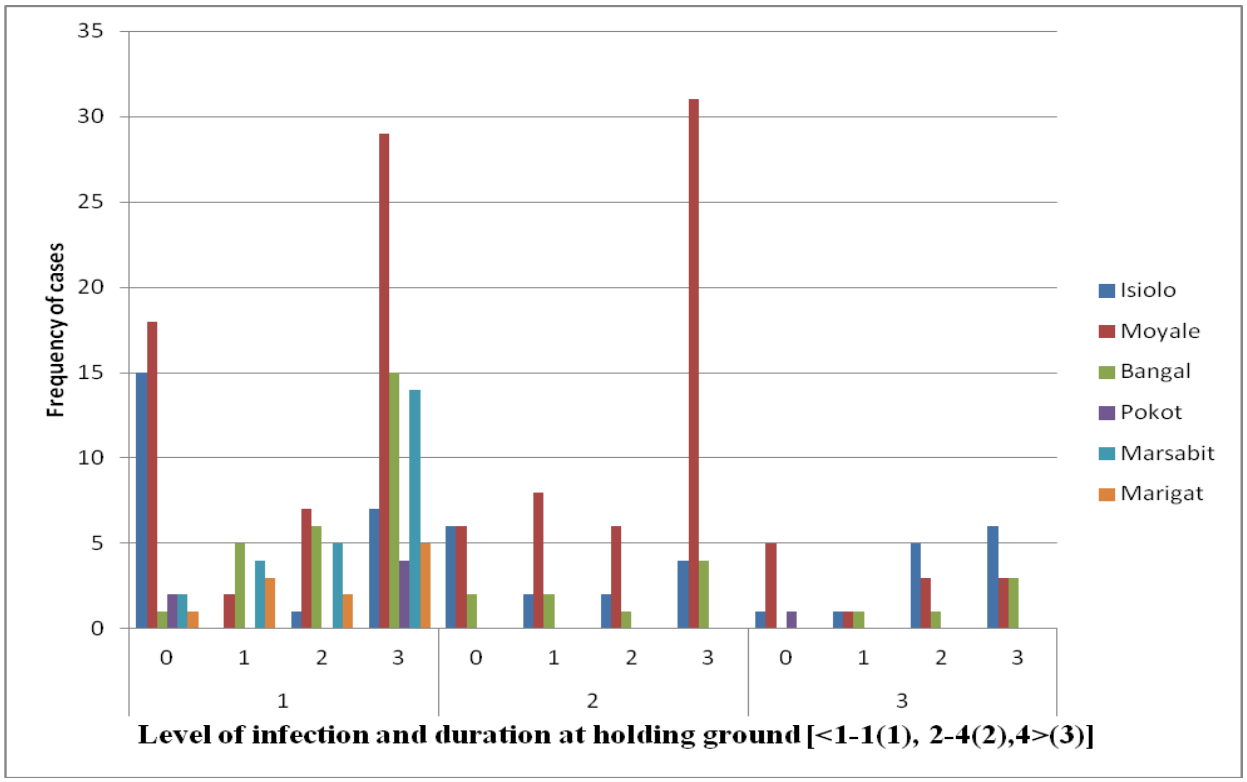


Table 7: Showing distribution of camels with respect to age(young/adult)

	Young		Adult		
County	**Males**	**Females**	**Male**	**Females**	**TOTAL**
Isiolo	0	1	32	17	50
Moyale	1	5	34	79	119
Bangal	2	2	18	19	41
Pokot	0	1	1	5	7
Marsabit	3	1	13	8	25
Marigat	0	0	6	5	11

Age bracket years (1-3 years=young, >4 years=adult)

Most of the camels brought to Athi River abattoir for slaughter are adult 93.67% (237/253), with adult females been more than male counterpart forming 56.1%(133/237) of adult population.

Figure8: Graph showing distribution of camels in terms of age (Young/adult)

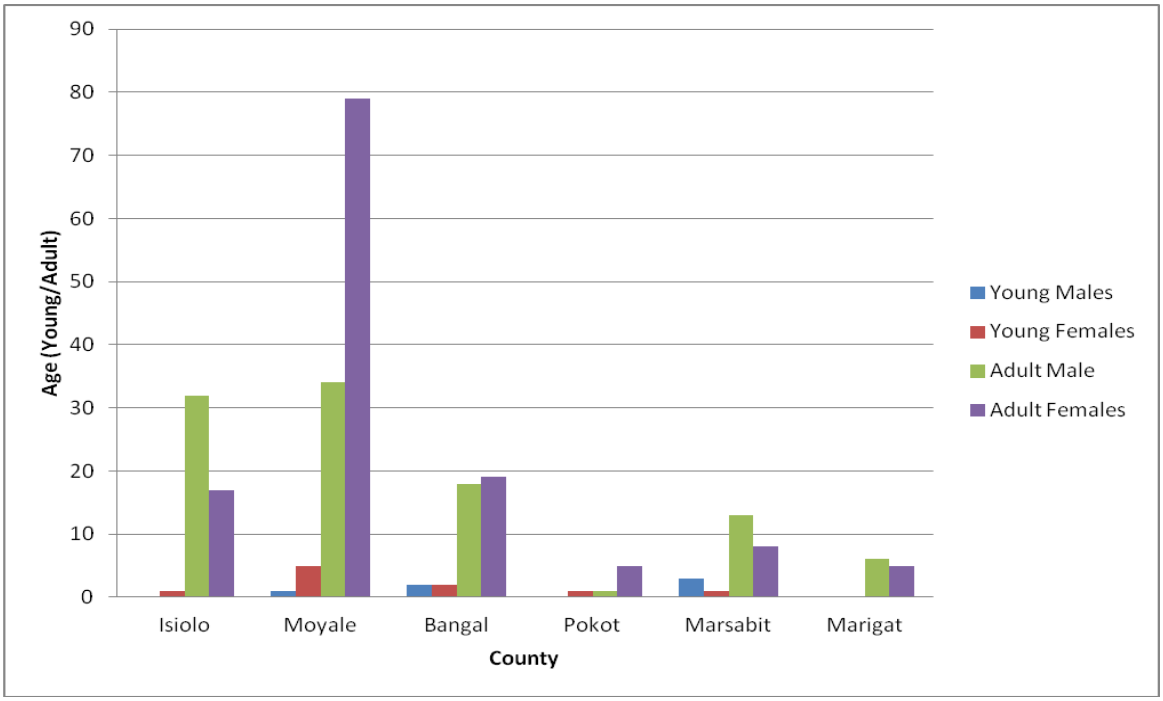
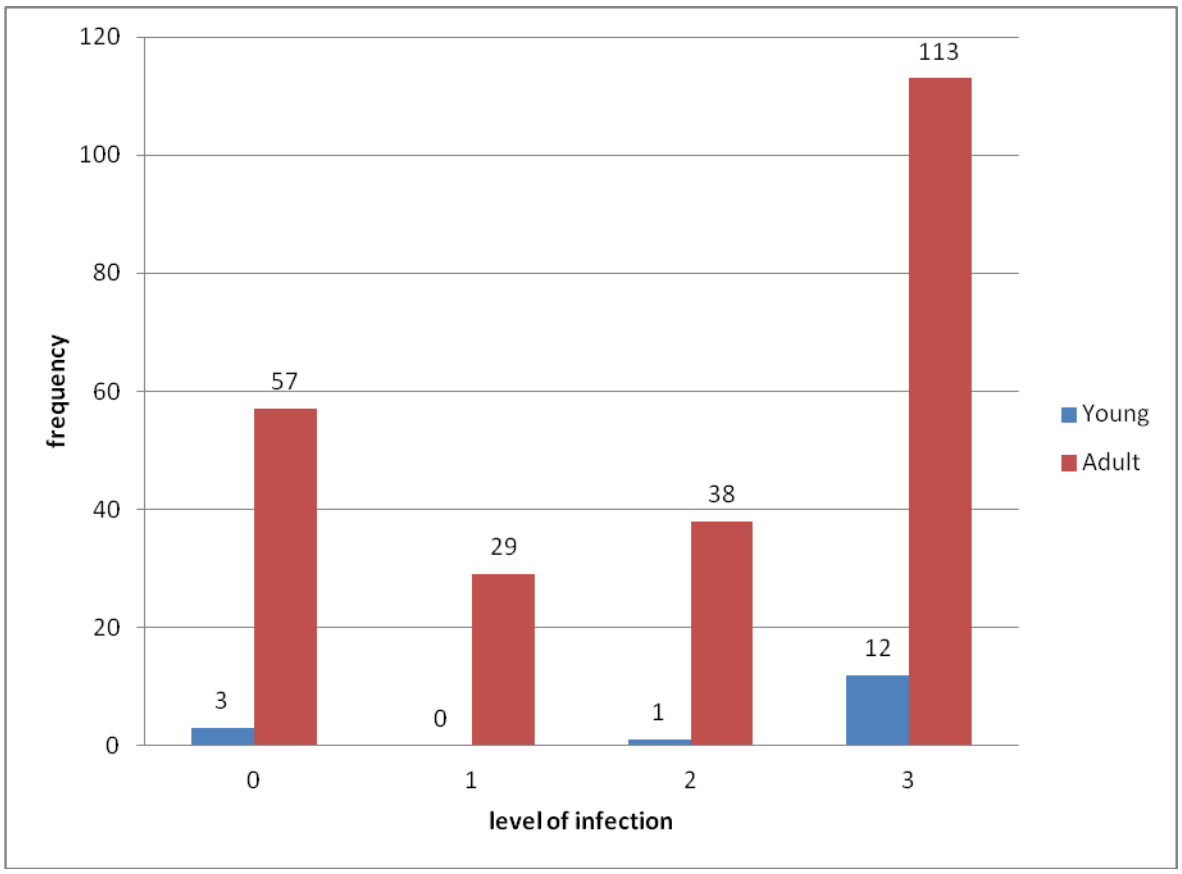


Figure 9: Graph showing relationship between Age and level of infection.



CHAPTER FIVE

5.0 DISCUSSION

Camels brought to Athi River for slaughter from various counties were found to be heavily infected with various species of helminths and coccidian. Among the Nematodes *Haemonchus, Ostertagia* and *Trichostrongylus* were the most isolated helminths in this study. These findings agrees with similar study done by A. Mahmuda **(**2012) in determining Prevalence of gastrointestinal round worms in calves in Sokoto, Northwestern, Nigeria. The high prevalence of *Trichostrongylus* and *Haemonchus* species evident in this study also agrees with similar findings by (Abdul-Salam and Farah, 1988; Kamani *et al*., 2008). This result supports previous findings that Nematodes are the commonest helminths in camels (Abdul-Salam and Farah, 1988; Mohammed *et al*., 2007; Kamani *et al*., 2008).

Another finding in this study is that there are more adult camels brought for slaughter in Athi River abattoir than young in which adult female are more than male counterpart. This could be a factor of market price or culling effect. Also shown in this study is the high level of worm infection on adult camel than young, this agrees with study by *A. Mahmuda (2012)*and his recommendation that delayed exposure of camel calves to grazing field can reduce early exposure of calves to parasites(Mohammed. *et. al,*. 2010). The study also demonstrates high level of worm infestation on camels sampled from all the six counties where these camels are sourced.

There is paucity of literature as helminths infections of camels are generally regarded as less of a problem than those in other ruminants. However, gastrointestinal Nematodes are known to undermine the overall health and productivity of camels (Borji 2010). On focus group discussion the Camel owners/keepers have disclosed/discovered high level lack of information about camel helminths by the camel keepers, and contrary they believe camel is most resistant and rarely affected by gastrointestinal worms and therefore they don’t consider deworming to be necessary.

The camel owners/keepers further stated that they dispose severely ill camels by slaughtering at the abattoir and those showing mild sickness they administer locally available antibiotics without observing any dosage procedure or regime. Therefore, they are not aware nor seek any veterinary intervention. Study on Intestinal Parasitic Infections of Camels in the Agro and Pastoral Areas of Northern Tanzania by (Swai E. *et. al,.* 2011), found that drenched camels prior to the sampling for study were associated with low level of helminths excretion. Potential public health associated risk could be arising from consuming meat from severely ill slaughtered animals and drug resistance from consuming product of animals with drug in the body.

Interview with the meat inspector at the abattoir it was pointed out that they have no clear procedure to observe in inspection of Camel carcass, therefore they assume and informally inspect adapting bovine meat procedure. This could lead to uninspected meat finding its way in to market, consumed and thereby imposing public health risk.

Meat of Camels slaughtered at Athi River abattoir is mainly sold at informal butcheries in which lack proper structural outlay and the hygiene standard is compromised in Eastleigh estate of Nairobi. Eastleigh largely inhabited by people of pastoralist background who believe Camel products are precious and even linked to medicinal myth, therefore hot selling in the market.

Animal welfare issues also arise in the way these camels are killed. The camels here are packed in limited spaced abattoir and while intensely excited due to the commotions and crowded inside, slaughter man walks in with a knife and severe the jugular at the base of the neck of the camel either standing or sitting position. Then the camels bleed to collapse before they are skinned on the ground.

Of public health significance is the way the meat is handled at the slaughter house. Knowing the fact that this abattoir is designed for the shoats and bovine and therefore short of space to accommodate many camels, the Camels are bleed, skinned and slaughtered at the floor leading meat scattered all over the floor posing higher risk of contamination.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATION

6.1 CONCLUSION

From the study, the following conclusion can be drawn;

- This study demonstrates that camels are infected with a range of helminths species and Coccidian ooocysts.
- The common gastrointestinal parasites encountered in this study like the Tapeworm and *Coccidia* have both economic and public health significance as heavy protozoan infection may cause significant impact in young camels resulting into high morbidity and mortality (Chineme, 1980; Boid *et al*., 1986; Kinne and Wernery, 1997). and (Ukashatu S. *et. al*,. 2012). In cases where the camel is an intermediate host like *Linguatulosis*, proper disposal of infected organs is very important.

6.2 RECOMMENDATIONS

From the conclusions of this study, the following recommendations are give:

1. Thus, there is a need for the sensitization of camel keeping communities for the need to deworm their animals using effective anthelmitics for deworming of camels.
2. Further epidemiological studies should be done in different seasons and parts of Kenya to understand the transmission and seasonal dynamics of the helminths of camels in the country.
3. A study of the epidemiology, pathogenicity, treatment and control strategies, and the immune response of camels to the infection of various worms' genera/species will be of great help.
4. More work for longer period involving more camels and possibility of total worm counts and identification.

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APPENDICES

APPENDIX I: INDIVIDUAL ANIMAL DATA CAPTURE SHEET

Date	Sample ID	Trader ID	County of origin	Source type	Sex	Age(years) of animal	Duration in holding ground
		Owner's Name		e.g. Market			e.g. 1 month.