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Study of Internal and External Parasites in Cats

(*Feliscatus*) in Animal House Veterinary

Hospital in Salmiya region, Kuwait

**دراسة للطفليات الداخلية والخارجية في القطط بمستشفى بيت الحيوان
البيطري**

بمنطقة السالمية، دولة الكويت

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DEDICATION

TO

My Parent, Brothers, Sister and Dear Wife

Acknowledgement

First of all, I would like to thank the God who gives me the ability and enough power to finish this work and research, I am deeply honor all the efforts and advices and faithful help, planning of the work, correction and sincere guidance that facilitate completion of this work from my supervisor Professor **Siham Elias Suliman** of Department of Medicine and Animal Surgery, College of Veterinary Medicine. Many thanks to Professor Mohamed Abdelsalam Abdalla the Dean College of the Graduate studies Sudan University of Science and technology, for his encouragement to carry out this work, I am deeply indebted to Dr. Samira Wasily Director of Animal House Veterinary Hospital, Kuwait for her Kind Cooperation and offering me to use the Facilities required for sampling and examination.

Abstract

This study was conducted from November 2014 to November 2015 in Animal House veterinary Hospital Salmiya region, Kuwait state to determine the prevalence of suspected internal and external parasites in domestic cat (*Feliscatus*). A total of 150 cats were examined. These animals were in different age, sex, and breed. External parasites were examined using skin scraping, and examination of fur done and ear smears taken from all selected cats. For internal parasites fecal samples collected from all selected cats (10-15 cats per month). Macroscopic examination was used to detect the adult parasites and cestodes proglottids. Direct Centrifugal flotation technique (DCFT) used for detection of internal parasites and their eggs and larval stages as well as. The results showed that 18% (27/150) cats infected by ear mites (*Otodectes cynotis*). Prevalence rate of *Otodectes cynotis* among males and females was 21.95% (18/82) and 13.23% (9/68) respectively ($p < 0.05$). Hookworms (*Ancylostomatubaeforme*) in these animals were 22% (33/150), and among males and females the prevalence was 20.7% (17/82) and 23.5% (16/68) respectively. This parasite in contact with stray cats was 3.03 % (1/33) no significant effect on prevalence between infected by *A. tubaeforme* and contact with stray cats ($p > 0.05$). The prevalence rate of *A. tubaeforme* at different sources of cats was high from adoption society's sources of cats 25% (2/8). In *Isospora felis* the prevalence rate was 7.3 % (11/150) and among males and females was 8.5% (7/82) and 5.8% (4/68) respectively ($p < 0.05$). The prevalence rate of *I. felis* from different source of cats was high from another breeder sources 30.43 % (7/23). The prevalence rate among different age groups was significant in infected cats by *A. tubaeforme*. Multivariate analysis showed that there was significant association between the age of the cats and infection by *Isospora felis* and *Ancylostomatubaeforme*. The result of the present study provide more information about external and internal parasites in domestic cats (*Felis cats*) in Kuwait and risk factors contribute to breeding domestic cats indoor and increased the awareness of zoonosis of cats in public health in Kuwait state.

ملخص البحث

اجريت هذه الدراسة على القطط الاليفة بمستشفى بيت الحيوان البيطرى بمنطقة السالمية، دولة الكويت في الفترة من نوفمبر 2014 الى نوفمبر 2015 للتعرف على معدلات انتشار الطفليات الخارجية والداخلية للقطط التي تزور المستشفى. تم فحص هذه القطط عيانيا للتعرف على الطفليات الخارجية و تمشيطها للتعرف على الطفليات الموجودة على جلدها كما تم اخذ مسحات من اذناها للبحث عن حلم جرب الاذن، كما اخذت كشطات جلديه لحلم الجرب من الحالات المشتبهة، كما تم فحص جميع عينات البراز عيانيا للتعرف على الطفليات الناضجة والديدان الشريطية، كما تم فحصها مجهريا باستخدام طريقة الطفو بالنبد المباشر للكشف عن البيوض، والاطوار المتكيسة للطفليات الداخلية. اظهرت الدراسة اصابة 27 من القطط بحلم جرب الاذن بمعدل انتشار 18%، حيث بلغ معدل انتشار جرب الاذن بين الذكور والاناث 21.95% (27/150) على التوالي. اظهرت الدراسة وجود فروق معنوية لمعدل (9/68) و 13.23% (18/82) اظهرت الدراسة ارتفاع معدل ($p < 0.05$) انتشار حلم جرب الاذن بين الذكور والاناث انتشار جرب الاذن في القطط التي كان مصدرها الشارع مقارنة بالمصادر الاخرى. اظهرت الدراسة اصابة 33 من القطط بديدان الانكلستوما بمعدل (2/5) للقطط 40%. كما بلغ معدل انتشار الديدان بين الذكور والاناث (33/150) انتشار 22% على التوالي. كما اظهرت الدراسة عدم وجود (16/68) و 23.5% (17/82) 20.7% فروق معنوية لمعدل انتشار الديدان بين الذكور والاناث عند المستوى. اظهرت الدراسة كذلك وجود قط واحد من القطط المصابه بديدان الانكلستوما ($p > 0.05$) اظهرت الدراسة عدم وجود (1/33) كان محتك بقطط الشارع بمعدل انتشار 3.03% فروق معنوية بين معدل الانتشار للاصابة بديدان الانكلستوما و الاحتكاك بقطط الشوارع. اظهرت الدراسة ارتفاع معدل الاصابة بديدان الانكلستوما في القطط التي كان ($p > 0.05$) كما اظهرت الدراسة (2/8) مصدرها جمعيات تبني القطط حيث بلغ معدل الانتشار 25% وجود فروق معنوية لمعدل انتشار ديدان الانكلستوما و المجموعات العمرية المختلفه. اظهرت الدراسة اصابة 11 من القطط محل الدراسة ($p < 0.05$) للقطط عند المستوى. كما بلغ معدل انتشار الطفيل بين (11/150) بطفيل الايزوسبوا بمعدل انتشار 7.3% على التوالي. كما اظهرت (4/68) و 5.8% (7/82) الذكور والاناث المصابه 8.5% الدراسة وجود فروق معنوية لمعدل انتشار الاصابة بالطفيل بين الذكور والاناث المصابه. كذلك اظهرت الدراسة ارتفاع معدل انتشار الطفيل في القطط ذات ($p < 0.05$) بالطفيل المصدر من مربى اخر مقارنة بالمصادر الاخرى للقطط حيث بلغ معدل الانتشار للطفيل. كذلك اظهرت الدراسة عدم وجود فروق معنوية بين معدلات انتشار (7/23) 30.4% الاصابة بديدان الانكلستوما و طفيل الايزوسبوا و حلم جرب الاذن والوحدات الاداريه

اظهر التحليل متعدد المتغيرات وجود ارتباط بين اعمار ($p>0.05$) القادمة منها القطط القطط محل الدراسة و الاصابه بديدان الانكلستوما وطفيل الايزوسبورا . هذه الدراسة قد اعطت مزيد من المعلومات عن الطفليات الخارجيه والداخليه فى القطط بدولة الكويت و عوامل الخطر وزيادة الوعى بمخاطر الامراض المتناقله بين الانسان والقطط و اثرها على الصحة العامة بدولة الكويت.

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Introduction

Contingent the parasite species and its availability, infection may cause varying symptoms in cats, from mild gastro-intestinal disorders and failure to thrive, to anemia or anorexia in the more severe cases, particularly in kittens with heavy parasitic load (Traversa, 2012). Some parasites of cats have a zoonotic hazards, either through close contact with infected animals or through exposure to a contaminated environment (Raether and, Hänel, 2003; Petavy *et al.*, 2000). This is the case for some nematodes such as *Toxocara cati* and *Ancylostoma tubaeformae*, which are responsible for human visceral/ocular and cutaneous larva migrans, respectively (Fisher 2003; Robertson and Thompson, 2002). Humans may also become infested with zoonotic cestodes from cats such as *Dipylidium caninum* or *Echinococcus multilocularis* (Deplazes *et al.*, 2011; Petavy *et al.*, 2000). External parasites can cause direct damage when infesting pets, such as discomfort, pruritus and allergic reactions, but they have also a potential vectorial role: fleas are for instance involved in the transmission of zoonotic pathogens, especially *Bartonella henselae*, the causative agent of cat-scratch disease (Beugnet and Marié, 2009). Parasites of cats are thus a threat for both animal and human health. Domestic cats are a huge part of the growing pets, there are 600 millions cats worldwide, 25% of them are indoor cats and 75% of them are outdoor cats (stray cats) (Margaret Mccluskey, world society for protection of Animals). In Kuwait there are not enough statistical data available on the numbers on Internal and External parasites in cats, some published literature regarding the prevalence of Internal Parasites in stray cats from Kuwait were done. (Osama *et al.*, 2015). Almost all surveys carried out have been based on coproscopical analysis and focused on the carriage of intestinal nematodes, cestodes and protozoans. The prevalence appears to be higher in cats from

shelters or in stray cats, varying from 33% to 90-100% in some studies (Becker *et al.*, 2012).

Objectives:

1/ To improve knowledge on the prevalence of the occurrence of internal parasites and external parasites infections, in household owned cats in Kuwait.

2/To examine risk factors and their influence on parasitism.

Chapter One

Literature Review

1.1 Taxonomy and Species Description and Distribution of cats (*felis catus*)

In zoological taxonomy , domestic cats (*Felis catus*) belonged in the Domain Eukarya because their cells have a nucleus and membrane-bound organelles (Fig.1.1), Kingdom Animalia , phylum Chordata , class Mammalia ,Order Carnivora , Family Felidae , Genus *Felis* , Species *catus* (Dewey, 2005). Domestic cats are characterized by a number of well-known physical characteristics. These include a flexible and compact body ,keen eyesight and adaptations for visual acuity at night ,retractable claws ,sharp teeth and a reduction in numbers of teeth (the hind chewing teeth)reflecting adaptation as a carnivore, long vibrissae (whiskers)and a long flexible tail important as an aid to balance (LaBruna, 2001) . *Felis catus* is among the smaller members of the felid family, but share with other family members the trait of being an agile and efficient predator. *Felis catus* was domesticated in the eastern Mediterranean (Fig.1.2) since 3000 years ago .*Domestic Felis catus* are believed to be the result of several millennia of human domestication of one or both of two closely related wild species ,the European wild cat ,*Felis silvestris* (probable ancestral line),and the African wild cat *Felis lybica* . the area of original domestication is believed to be centered in or around Egypt. Domestic and escaped feral *F.catus* are now distributed worldwide, not withstanding a few isolated islands where the species has either not been introduced by humans or has failed to become established (LaBruna2001).

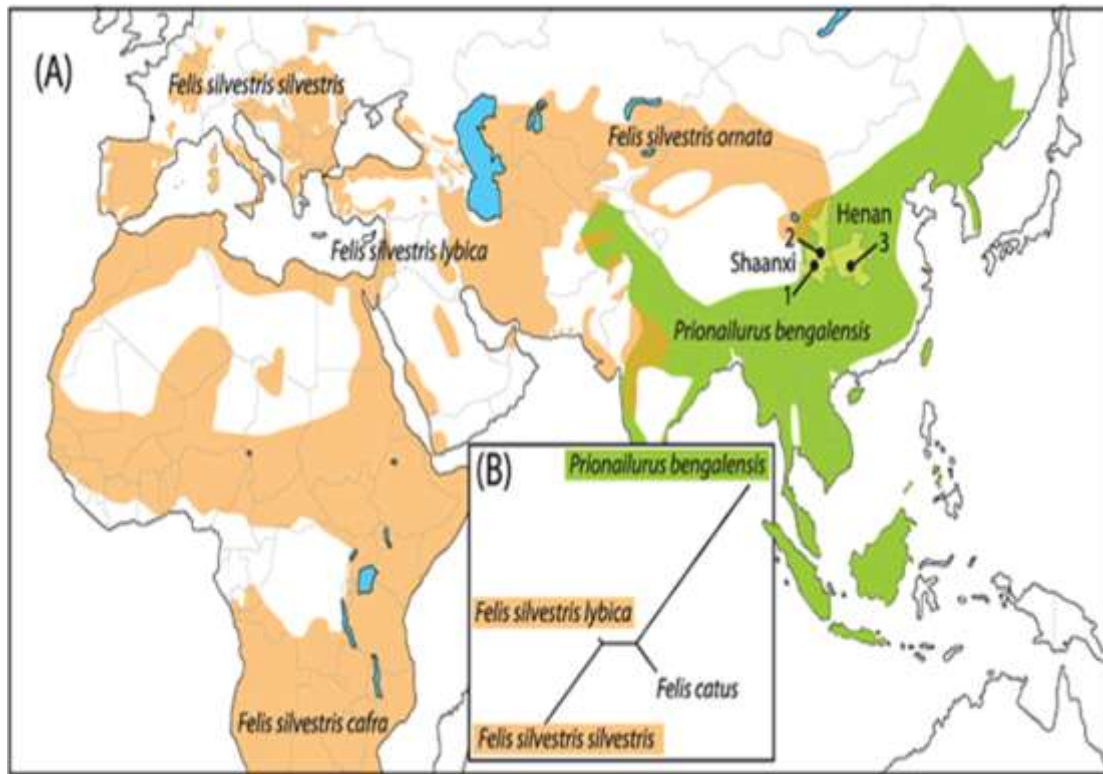


Figure 1.1: the Origins of Genus *Felis catus*

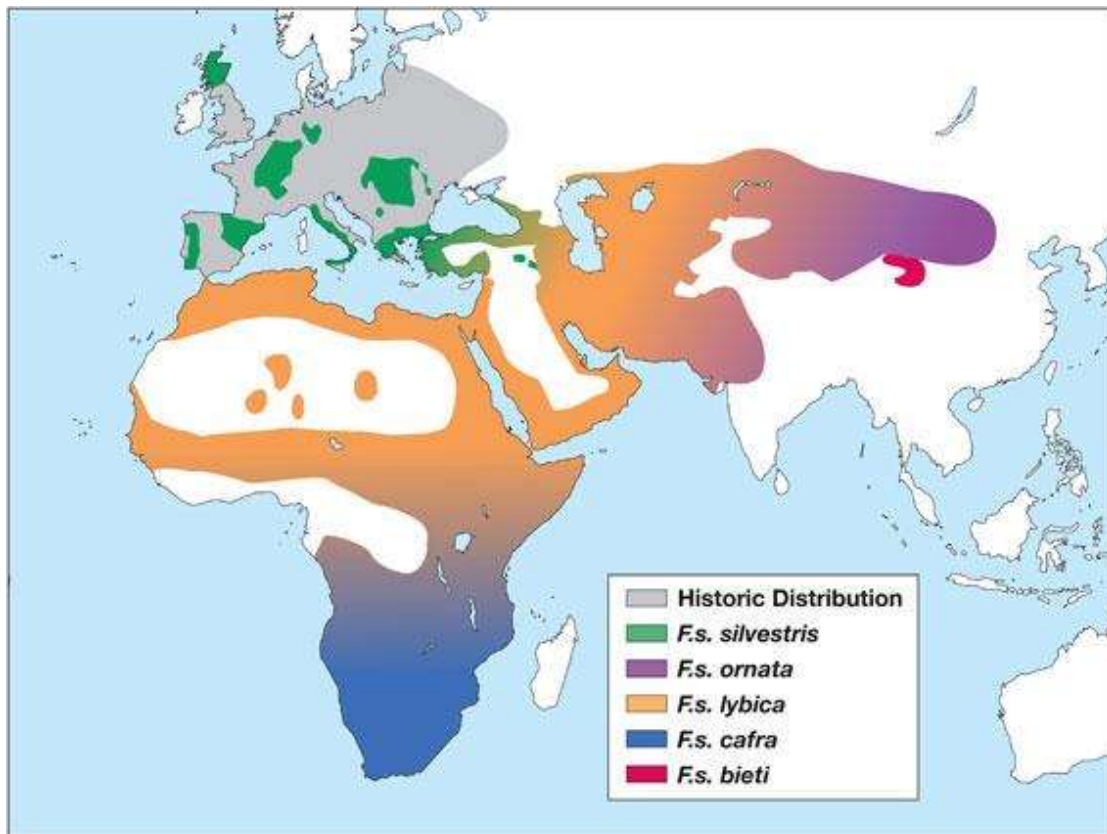


Figure 1.2: Distribution of Origins of *Felis catus*

1.2 Potential and Economic Importance of cats

Domestic house cats have significant positive economic value for companionship and for vermin control. In the feral *Felis catus* population, however, these positive are outweighed by the ecological damage these animal can cause in addition to the ecological impacts, *Felis catus* carries a number of diseases that are transmissible to humans, including rabies, cat – scratch fever and various parasitic infections (Dewey, 2005). Efforts to manage feral cat population are costly, and households in expend money for food, housing, health care and vaccination, deworming of pet cats and grooming. On the other hand many household get good profit from breeding pet cats and trading of it.

Felis catus species has been nominated as among 100 of world's worst invaders by the Invasive Species Specialist Group (ISSG).

1.3 External parasites in cats

1.3.1 Definition of External parasites

A parasite that lives on the outer surface of its host, such as fleas, louse, mites, or tick. External parasites in cats may affect the eyes, ears and the skin of the cats and sometimes all over the body in weak kittens or older animal with weak immunity. Fleas are the parasites that are most frequently seen in felines ,there are also other parasites that may cause health problems including mites ,lice or ticks .External parasites may cause discomfort ,anemia ,allergies or may also carry various diseases that can be transmitted when the parasites bite the pet(**VetInfo, 2012**).

1.3.2 Fleas of cats

1.3.2.1 Classification and Definition

Fleas of cats (*Ctenocephalides felis*) belong to Kingdom Animalia, Phylum Arthropoda , Class Insecta ,Order Siphonaptera , Family Pulicidae , Genus *Ctenocephalides* ,Species *Ctenocephalides felis* (**Shaw., 2004**).The fleas of cats are insect from the Siphonaptera order .The fleas don't have wings ,but may jump and feed on the cats blood .The fleas are species specific ,which means that cats may be affected only by cat fleas ,also known as *Ctenocephalides felis*. Fleas reproduce quickly and have a complex life cycle ,so they can be problematic to eliminate fleas may cause various problems in feline like primary intermediate host of *Dipylidium caninum* and also transmit *Bartonella henselae*(**Beugnet and Marie,2009**).

1.3.3 Lice of cats

1.3.3.1 Classification and definition

Lice of cats belong to Kingdom Animalia , Phylum Arthropoda Subphylum Hexapoda ,Class Insecta ,Order Psocodea. Family Trichodectidae Genus

Felicola , Species *subrostratus* (Cat Biting Louse) (**Gary and Lance, 2009**). Lice are dorsoventrally flattened wingless insect with three legs pairs and a distinct head, and are small about the same size as fleas , lice are highly host –specific ,so differentiation of head morphology ,host species ,and sometimes location on the host are usually sufficient to identify lice for diagnosis purposes. There are two major groups of lice with distinct head morphologies reflective of difference in feeding habits and vector competence. *Mallophaga* (chewing lice) grasp host hair (or feathers) with their mouth parts, these chewing lice have large mandibles that result in wide heads. *Anoplura* (sucking lice)have narrow heads because their mouthparts are adapted for sucking blood or fluids.Sucking lice also have more developed claws for grasping fibers such as hair. *Felicola subrostratus* a chewing louse of cats is usually found in large numbers only on aged or diseased cats and on some wild felids ,its yellowwith brown transverse bands, around 1mm in length has antenna with three clear segments ,and triangular headwhich is important aid in identification process.

1.3.4 Mites of cats

1.3.4.1.Classification and definition

Mites belong to Kingdom Animalia ,phylum Arthropoda , subphylum Chelicerata ,Class Arachnida ,subclass Acarina , super order Acariformes , Order Astigmata, Unranked Psoroptidia , Superfamily psoroptidae, Sarcoptidae ,several Genera Otodectes, Notoedres , Cheyletiella ,lynxacarus, Demodex, (**Myers *et al.*, 2017**)

Mites belonged to arachnids , mites have a rather particular morphology ,in mites thecephalothorax and abdomen are fused. Therefore ,the two different regions of the body are no longer distinguishable and have four pairs of legs and they don't have antennae ,wings and they cannot fly .They have simple

eyes that are sensitive to light intensity ,they do not see images but just hazy spots of lights .

1.3.4.2 Feline scabies(*Notoedres cati*)

Infestation with *Notoedres cati* mites is rare and highly contagious skin disease the mites appearance and life cycle are very similar to that of sarcoptic mange mites.

1.3.4.3 Ear Mites(*Otodectes cynotis*)

Otodectes cynotis (ear mites) has been reported from dogs ,cats ,foxes and ferrets worldwide.

1.3.4.4 Hairclasp Mites(*Cheyletiella blakei*)

Feline species *Cheyletiella blakei*, *lynxacarus radovsky* ,canine *Cheyletiella yasguri* ,*Cheyletiella* spp. are also referred to as(walking dandruff) mites.

1.3.4.5 Demodex Mites

Feline Demodex species are *Demodex cati* ,*D. gatoi*, in canine *D. injai*, *D. canis*, *D. corni*, .Most *Demodex* spp. is considered normal mammalian parasites. All stages of the life cycle (eggs, larvae, nymphs, adults) reside within the lumen of hair follicles and within sebaceous glands duct, some species are more commonly found in the stratum corneum. Development from egg to adult takes approximately 20 to 35 days and is completed entirely on the host (Myers *et al.*, 2017).

1.3.5 Ticks of cats

1.3.5.1 Classification and definition

Kingdom Animalia ,Phylum Arthropoda ,Class Arachnida ,Subclass Acari ,Superorder Parasitiformes ,Order Metastigmata(Ixodida) ,Superfamily

Ixodoidea ,Family Ixodidae(hard ticks) , several genera ,*Ixodes* ,*Dermacentor*,*Amblyomma*, *Rhipicephaleus*. There are more than 650 species of hard ticks (apart of Ixodidae family) the adult tick has eight legs and mouth parts that attach and suck blood from the host animal until the tick is completely filled with blood this blood meal allow the female tick to produce eggs and continue the life cycle of the tick .Ticks find their hosts by climbing up on to blades of grass or tall weeds in order to grab on to passing animals or human ,this called questing position , then find suitable location on the animal to attach and feed for several hours ,or even several days . Ticks are not only unsightly and disturbing to find on ones ,body or one's cats or dog they can also carry some serious diseases that can be transmitted to human and pets(Myers *et al.*, 2017).

1.3.5.2 *Ixodes scapularis*(Deer ticks)

Ixodes scapularis is commonly known as the deer tick or black legged tick it is a hard –bodies ticks family (Ixodidae)it's found in eastern and northern Midwestern united states .It is a vector for several diseases of animals ,including humans

(lyme disease ,babesiosis ,anaplasmosis ,powassan virus disease ,etc) and is known as the deer ticks owing to its habits of parasitizing the white –tailed deer .It's also known to parasitize mice ,lizards ,migratory birds ,etc .especially while the tick is in the larval or nymphal stage.

1.3.5.3 *Dermacentor variabilis* (American dog tick)

This species of ticks prefer to feed from dogs ,cats ,rabbits, red fox, human this ticks transmitted many diseases to human like Rocky mountain spotted fever and tularemia as well as tick paralysis (Sexton, 2012) ,the wood ticks or

American dog ticks have three life stages after hatching from eggs ,wood ticks develop from the eggs stage to larvae ,nymph and finally the adult .their size and coloration vary depending on the life stage .wood tick adult females generally are about 0.25 inch (5-6mm)in length when unfed and are reddish brown in color .Adult females have a dorsal shield behind their body and has creamy –white to silvery – gray marking or striations. females will vary in size depending on whether they have taken a blood meal .blood fed or engorged females can enlarge to up 0.5 Inch in length or 15 mm long and 10 mm wide (**Chan and kaufman 2008**) adult male ticks smaller in size (3.6 mm in length)than females ,and are also reddish brown with cream to silver – gray colored vertical marking or line over the entire back .The head and mouth parts of wood ticks are more rectangular in shape compared to the deer tick the larvae and nymph are yellowish brown in color and they become grey after engorged .

1.3.5.4 Amblyomma americanum

The lone star tick, *Amblyomma americanum* , was first described by(Linnaeus in1758). lone star ticks feed on the blood of various animals (domestic and wild)as well as humans .the new studies have shown that this species can transmit various other pathogens to humans and other animals ,such as those that cause ehrlichiosis ,richettsiosis ,tularemia ,and theileriosis(Linnaeus in1758).

1.3.5.5 Brown dog tick (*Rhipicephalus sanguineus*)

the brown dog tick or kennel tick is one of the most widely distributed tick on the world it is generally believed that this species of tick can seen in overwinter in the more northern united states or northern Europe except within buildings with centralized heating . the brown dog tick is almost exclusively a parasite of dogs for this reason ,all tick life stages may be found

behind baseboards, under window and door moldings ,in window pulley openings or in furniture .

1.3.6Diagnosis of External parasites in cats

Diagnosis of external parasites of cats is based on clinical signs and physical examination (itching and scratching body or ears) and on demonstration of the external parasite(lice ,mites ,fleas ,ticks) on the cats as well as skin scraping for mites and sometimes due to cats licking behavior found external parasites in feces during fecal flotation test .

1.3.7 Prevention and control of External parasites in cats

External parasites include fleas ,ticks mites and lice .there are a number of product available that can control and treat pets when infected with these parasites ,and these are regular used of spot-on preparations ,keep away other pets, also keep pet indoor during the external parasites seasons , preventing pets from suffering skin irritation and skin disease ,worm infection and other types of disease ,many of these parasites can infect people too causing irritation and possible health problems therefore ,treating (Myers *et al.*, 2017). Fleas are the most common parasite affecting pets and can infect other pets within in home as well as bite .Fleas are the most common cause of skin disease in the dog and cats and can also infect your dog or cat with tapeworms. Most pets are treated every one or two months with a spot –on preparation .the commonest signs that your pet may be infected with fleas are that they may persistently scratch or show evidence of skin irritation such as Redding or hair loss .Some animals may not show any signs that they are infected with fleas. .All pets in the household must be treated ,not just the one that you think is infected .this is because all your pets will have fleas if one of them has fleas .(Myers *et al.*, 2017).

1.3.8 Treatment of External parasites of cats

1.3.8.1-spot –on treatment

Using an over the counter spot –on medication that can be a very effective method for controlling both ticks and fleas.

1.3.8.2-Oral medication

Once a month pill are not as readily available cats as for dogs ,and most tick prevention pills used for cats are actually pills made for small dogs.

1.3.8.3-Shampoos

Bathing your cat with shampoo that contains medicated ingredients will generally kill ticks on contact .this can be an expensive method of protecting your cat during the peak tick season .you will also need to repeat every two weeks .

1.3.8.4-Tick Dips

A dips is a concentrated chemical that needs to be diluted in water and applied to the animals fur with a sponge or poured over the back .

1.3.8.5-Tick collars

Collars that repel ticks are an additional preventive can be used , though they are mainly only useful for protecting the neck and head from ticks .the collar needs to make contact with cats skin in order to transfer the chemical onto the cats fur and skin ,making sure there is just enough room to fit two fingers under the collar when its around the cats neck ,collars impregnated with the chemical Amitraz should never be used on cats .

1.3.8.6-Powder

Another method of topical medication, tick powder are an effective method for killing and repelling ticks from pet. Reapply the powder about once a week during the peak ticks season, be sure that the powder are using is labeled for cats before used.

1.3.8.7-Tick spray

Another medicated topical application, tick spray kills ticks quickly and provides residual protection, spray can be used in between shampoos and dips ,and they can be useful if cat spend significant time in wooded areas .

1.3.8.8-Treat the house and lawn

A trimming of bushes, trees and Keeping lawn trimmed can help in reducing the population of fleas and ticks and yard sprays or granular treatments that are available.

1.3.8.9 Ivermectin tablets

In cats ivermectin is also used at extralable doses to treat ectoparasites. A single dose of 200 microgram /kg used and 400microgram/kg in treating *Notoedres cati* and *Cheyletiella* .

1.4 Internal Parasites in Cats

1.4.1 Definition and Classification of Internal parasites

A parasite such as protozoon or worm that lives within the body of the host, occupying the digestive tract or body cavities or living within body organs ,blood , tissues, or cells(**Farlex and Partners 2009**).

1.4.2 Cestodes of cats classification and definition

Cestodes belong to Kingdom Animalia ,phylum Platyhelminthes , Class Cestodes.

Cestodes or tape worms are one of most common parasite of cats, Cyclophyllidean cestodes have indirect life cycle require specific intermediate hosts .Cestodes that affect cat larval stages ,have two basic life cycle one involving an aquatic environment for early Amphibian ,reptiles and the second utilizing various vertebrate host such as fish ,mammals .Some cestodes do not use intermediate host in aquatic environment and used terrestrial host ,such *Dipylidium caninum* which used fleas in all cases cats become infected by eating intermediate host which contain larval stage of the cestodes ,where its grows in to adult stages and live primarily in duodenum and jejunum usually treatment with paraziquantel (**Bowman, 2003**;).

1.4.2.1 *Dipylidium caninum*

1. Classification and Definition

Kingdom Animalia , Eumetazoa mteazoans,Bilateria bilaterally symmetrical animals,Protostomia protostomes ,Platyhelminthes Flatworm, class Cestoda ,Oder Cyclophyllidea,Family Dilepididae ,Genus *Dipylidium*,Species *Dipylidium caninum*.(**Dewey, 2017**)

Dipylidium spp are parasitic intestinal cestodes of wild and domestic cats in tropical and temperate countries ,the definitive host for this tape worm are mink, human ,dogs,cats bears,and other fish eating mammals .

1.4.2.2 *Echinococcus multilocularis*

1. Classification and definition

Kingdom Animalia , Eumetazoa metazoans, Bilateria bilaterally symmetrical animals, Protostomia protostomes , Platyhelminthes Flatworm, class Cestoda , Order Cyclophyllidea, Family Taeniidae , Genus *Echinococcus* , Species *Echinococcus multilocularis*. (Dewey, 2017). *Echinococcus* spp are parasitic intestinal cestodes of wild and domestic cats . Although *Echinococcus multilocularis* is the most commonly reported species which affect cats *E. granulosus* , *E. felidis* , *E. vogeli* have been experimentally infected to cats . the definitive host for the cestode are foxes, dogs, cats, coyotes wolves, and other wild canidae host include voles, shrews, field mice .

1.4.2.3 *Dipyllobothrium latum*

1. Classification and Definition

Kingdom Animalia , Phylum platyhelminthes , Class Cestodea, Order Pseudophyllidea, Family Dipyllobothridae , Genus *Dipyllobothrium* , Species *Dipyllobothrium latum*. *Dipyllobothrium* spp are a parasitic intestinal cestode of cats in temperate countries , the definitive host for this tape worm are mink , human, dog , cats , bear and other fish eating mammals.

1.4.3 Trematodes in cats Classification and Definition

Kingdom Animalia , Phylum platyhelminthes, Class Trematoda.

Trematodes or flukes are relatively rare parasite in cats and commonly seen associated with consumption of raw fishes. These parasites are often seen residing in small intestine where they cause minimal pathology unless in large numbers . Clinical signs in cats infected with pancreatic and liver flukes vary from asymptomatic to pancreatitis, cholangitis and cholecystitis , treatment is

effective with paraziquantel at dose from 5 to 20 mg /kg weekly(**Bowman, 2003**).

1.4.3.1 *Clinostomum* spp

1. Classification and Definition

Kingdom Animalia ,Eumetazoa metazoans,Bilateria bilaterally symmetrical animals,Protostomia Protostomes ,platyhelminthes flatworms, Class trematoda ,Order strigeatida, Family Clinostomatidae,Genus *Clinostomum*,Species *C.falastum* ,*C.kalappahi* ,and *C.adboni*,*C.marginatum*(Janson,1889) . *Clinostomum* spp are a parasitic fluke that commonly infected the buccal cavity of fish eating mammals, including human in Asia .This species have been in cats Including *C.falastum*, *C.kalappahi* and *C.adboni*.

1.4.3.2 *Paragonimus* spp

1. Classification and Definition

Kingdom Animalia ,Phylum Platyhelminthes,Class Trematoda ,Order plagiiorchiida,Family Troglotrematidae,Genus *Paragonimus* ,species *Paragonimus westermani*(Braun,1899).

Paragonimus spp are a parasitic lung fluke of cats .This parasite measuring 8 to 16 mm in length is found in subtropical and tropical countries such as southern Asia and Africa .Species recorded in cats include *P.kellicotti*,*P.siamensis* ,*P.proliferus* ,*P.heterotremes* ,*P.westermani* ,*P.skrjabini* ,*P.vietnamensis* ,*P.mexicanus* ,*P.miyazakii* p.*hekuoensis* .

1.4.4 Nematodes in cats

Classification and Definition

Phylum Nematoda, Class Chromadorea, Enoplea, Secernentea, Dorylaimea (Burmeister, 1837). Most parasitic round worms of cats have direct life cycle the free –living stages do not need an intermediate host for development but infect directly their final host, where they migrate to their predilection sites and complete development to adults. Inside the final host pregnant females produced thousands of eggs that are usually excreted with the feces of the host and contaminate pastures, rivers, lakes, etc, under favorable climatic conditions young L1 larvae hatch out of the eggs in a few hours, under adverse condition egg hatching is delayed or eggs may die (**Bowman 2003**).

1.4.4.1 *Aelurostrongylus abstrusus*

1. Classification and Definition

Kingdom Animalia, Phylum Nematoda, Class Secernentea, subclass Rhabditia, Order Strongylida, Family Angiostrongylidae, Genus *Aelurostrongylus*, Species *Aelurostrongylus abstrusus*. (Railliet, 1898) *Aelurostrongylus abstrusus* is a parasitic metastrongyloid found worldwide and live in the alveoli, bronchioles, bronchi and trachea of cats. Adult worms live within the epithelium of the trachea and bronchi and bronchioles.

1.4.4.2 *Ancylostoma* spp

1. Classification and Definition

Kingdom Animalia, Phylum Nematoda, Class Secernentea, Order Strongylida, Family Ancylostomidae, Genus *Ancylostoma*, Species *Ancylostoma caninum*, *Ancylostoma tubaeforme*, *Ancylostoma duodenale*. (**Dewey, 2017**) *Ancylostoma* spp are a parasitic intestinal nematodes of cats

worldwide, reported species in cats include *A.braziliense* ,*A.tubeforme* ,*A.ceylanicum* ,*A.caninum* .

1.4.4.3 *Toxocara* spp

1. Classification and Definition

Kingdom Animalia ,Phylum Nematoda ,Class Secernentea ,Order Ascaridida,Family Toxocaridae,Genus *Toxocara*. Species *Toxocara canis* ,*Toxocara cati*(**Dewey,2017**).*Toxocara cati* is a common parasitic ascarid of cat worldwide. Heavy infestation causes ill-thrift and fading kitten syndrome, but otherwise is asymptomatic.*T.canis* and *T,malaysiensis* have also been reported in cats .

1.4.4.4 *Dirofilaria* spp

1. Classification and Definition

Kingdom Animalia ,Phylum Nematoda ,Class Secernentea ,Order Spirurida,SuperFamily Filarioidea,Family Filariidae,Genus *Dirofilaria*, Species *Dirofilaria immitis*(**Dewey, 2017**).Parasitic spirurid nematodes ,one species which (*D.immitis*)causes heartworm disease in cats throughout temperate and tropical countries. Species which have been recorded in cats include *D.immitis* ,*D.repens*,*D.striata* .Infection is relatively rare in cats (rate of infection at 5 to 20% of dogs) but is increasing. Many cats are sub clinically infected and the infection tends to be self –limiting .Clinically affected cats may present at veterinary clinics with wide range of clinical signs such as ,chronic coughing labored breathing and vomiting ,however many infected cats die suddenly without any premonitory signs. Feline heartworm disease is clinically challenging on a number of different levels .Diagnosis and confirmation of this disease usually requires a combination of tests and treatment is most often limited to symptomatic therapy as curative

medical and surgical treatment place the feline patient at significant risk .Safe and effective prophylactic drug which kill a number of life –cycle stages are readily available .

1.4.4.5 *Thelazia* spp

1. Classification and definition

Kingdom Animalia ,Phylum Nematoda ,Class Secernentea ,Order Spirurida,Family Thelaziidae,Genus *Thelazia* ,Species *Thelazia californiensis*,*Thelazia callipaeda*(**Railliet and Henry,1910**). The eye worms *Thelazia californiensis* and *T.callipaeda* are parasitic spiroid nematodes reported in the literature to infect cats, this worms have been reported in Americas, Europe , Asia and Australia .

1.4.5 Protozoa in cats

1. Classification and Definition

The protozoa in cats belonging to the kingdom Protista and are members of the phyla Sarcomastigophora and Apicomplexa(**Yaeger,1996**). A phylum or grouping of phyla which comprises the single –celled microscopic animals ,which include amoebas ,flagellates ,ciliates ,sporozoans and many other forms, they are now usually treated as a numbers of phyla belonging to the kingdom Protista.

1.4.5.1 Coccidiosis(*Isospora felis* –*Cystoisospora felis*)

1. Classification and Definition

Domain Eukaryota ,(unranked) SAR, (unranked)Alveolata ,Phylum Apicomplexa,Class Conoidassida,Order Eucoccidiorida ,Family Eimeriidae,Genus *Isospora*, Species *Isospora felis*(Schneider ,1881). Coccidia are small protozoans (one –celled organisms) that multiply in the

intestinal tract of cats and dogs most commonly in kitten and puppies less than six months of age, in adult animals whose immune system is suppressed or in animals who are stressed in other way (change in ownership, other disease present).In cats and dogs most coccidia are of genus *Isospora* ,*I.felis*.*I.rivolta* are the most common species found in cats regardless of which species is.Generally the disease refers to coccidiosis. At a kitten ages ,its tends to develop natural immunity to the effects of coccidia ,as an adult and may carry coccidia in his intestine and shed the cyst in the feces ,but unexperience on ill effect .

1.4.5.2 Giardiasis in cats

1.Classification and definition

Domain Eukaryota, Unranked Excavata, Phylum Sarcomastigophora, Class Zoomastigophora,Oder Diplomonadida,Family Hexamitidae,Superfamily Giardiinae,Genus *Giardia* ,Species *Giardia cati*(**Kunstler,1882**).

Giardiasis is protozoan disease and parasites (one-cell organism) that live in the small intestine of cats and dogs .The parasite are found through the USA and in many other parts of the world .

2.Transmission

A cat become infected by eating the cyst from the parasite .In small intestine the cyst open and releases an active form called trophozoite ,these have flagella ,hair like structure that whip back and forth allowing them to move around ,they attach to the intestinal wall and reproduce encysts and is passed in the feces .The *Giardia* in the feces can contaminate the environment and water and infect other animals and people .

3.Symptoms

Most infection with giardia are a symptomatic ,in the rare cases in which disease occurs, younger animals are usually affected and the usual signs is diarrhea ,the diarrhea may be acute ,intermittent ,or chronic ,usually the infected animals will not lose their appetite but they may lose weight ,the feces are often abnormal being pale ,having a bad odor and appearing greasy in the intestine. Giardia prevent proper absorption of nutrients ,damages the delicate intestine ,lining and interferes with digestion .

4.Diagnosis

Fecal examination to see the cystic form usually found in firm stool and repeat the test for 3 days and can used the fecal flotation to see this form .for the active form fecal examination under microscope is the best way to see this form .since 2004 ELISA test used for diagnosis in veterinary office in 8 minutes and this test is more accurate and sensitive than fecal examination.

5.Treatment and control of Giardiasis

Fenbendazole and metronidazole and furazolidone has been effectively used for treatment and control of Giardiasis in cats usually don't used during pregnancy this drugs. For control controlling isolation and treatment all infected animals and used ammonium compound to cleaning kennels because this compounds effective against Giardia .

1.4.5.3Trypanosomiasis in Cats

Classification and Definition

Kingdom Protista, SubkingdomProtozoa, Phylum Sarcomastigophora,
Subphylum Mastigophor,ClassZoomastigophora,OrderKinetoplastida,Family
Trypanosomatidae,Section Stercoraria,Genus *Trypanosoma* Species

Trypanosoma cruzi(**Allen,2000**).*Trypanosoma cruzi* is a protozon (one –cell) parasite that causes a disease called American trypanosomiasis or chagas disease in man .The insect that pass *T.cruzi* from one host to the other is called kissing bugs . *T.cruzi* is found in south and central America where it is a significant cause of disease in human .It is estimated about 16-18 million people are infected in south and central America .*T.cruzi* is found rarely in southern United states .Small Animals such as cats ,dogs ,guinea pigs ,rats ,and opossums can serve as reservoirs for the parasite ,they can be very important in spread of the parasite.*T.cruzi* generally does not cause the significant disease in animals as it does in people .

1.4.5.4 Toxoplasmosis

1.Classification and Definition

Kingdom Protista, Subkingdom Protozoa ,Phylum Apicomplexa,Class Sporozoasida,Order Eucoccidiorida,Genus *Toxoplasma*,Species *Toxoplasma gondii*(**Nicolle and Manceaux,1909**) . *Toxoplasma gondii* is found throughout North America and can infect almost any warm-blooded animal or birds and human infection with *Toxoplasma gondii* a condition called toxoplasmosis ,can be very serious disease in human ,T.gondii can be passed from a pregnant women to her fetus and cause abortion and congenital defects .Estimation of 400 to 4000 cases of congenital toxoplasmosis occur in USA each year ,in children and adult and the disease causes other signs and is sometimes fatal. Also the disease is sever in person with poor immune system such as those undergoing chemotherapy or infected with human immunodeficiency virus (the virus that causes HIV-AIDS). It is estimated that approximately 11% of persons in the US have been infected with T.gondii , but the vast majority clear the infection with no or few symptoms.

1.4.5.5 *Tritrichomonas foetus* infection in cats

1. Classification and Definition

Domain Eukaryota ,Unranked Excavata ,Phylum Metamonada ,Class parabasalia,Order Tritrichomonadida,Family Tritrichomondidae,Genus *Tritrichomonas*,Species *Tritrichomonas foetus* (**Riedmueller,1928**). There have been a number of studies, initially from the USA , but now from numerous countries throughout the world ,that have demonstrated that *T.foetus* is an important cause of diarrhea in cats .it can infect and colonies the large intestine ,and can cause prolonged and intractable diarrhea . Studies have shown that this parasite mainly causes colitis (large bowel diarrhea) resulting in increased frequency of defecation ,semi-formed to liquid feces and sometimes fresh blood or mucous in the feces ,with severe diarrhea the anus may become inflamed and painful ,and in some cases the cats may develop fecal incontinence ,although cats of all ages can develop diarrhea ,it is most commonly seen in young cats and kittens.

1.4.5.6 *Hammondia* spp

1. Classification and Definition

Domain Eukaryota ,(unranked) SAR, (unranked)Alveolata ,phylum Apicomplexa,Class Conoidasida,Subclass Coccidiasina,Oder Eucoccidiorida ,Suborder Eimeriorina,Family Sarcocystidae,Subfamily Toxoplasmatinae, Genus *Hammondia*, Species *Hammondia hammondi*(**Dubey and Sreekumar, 2003**). Two species of *Hammondia* parasitize cats and dogs ,*H.hammondi* and *H.heydroni* resepectively.

1.4.5.7 *Cryptosporidium* spp

1. Classification and Definition

Domain Eukaryota , Unranked Sar ,Unranked Alveolata ,Phylum Apicomplexa ,class Conoidasida, Genus *Cryptosporidium* ,Species *Cryptosporidium felis*(Tyzzer,1907). *Cryptosporidium* Oocysts are very small and do not allow species differentiation based on morphology .In dogs and cats these species are found:*Cryptosporidium parvum* is a species with low host specificity and parasitizes mainly calves but can also infect a range of other mammals, including humans and occasionally dogs and cats .*C.canis* has been reported primarily in dogs and *C.felis* infects primarily cats but both have also been found in calves and human .Since species differentiation relies on molecular typing the exact distribution amongst positive cats and dogs is unknown.

1.4.5.8 *Sarcocystis* spp

1. Classification and Definition

Domain Eukaryota , Unranked Sar ,Unranked Alveolata,Phylum Apicomplexa ,class Conoidasida, Order Eucoccidiorida,Family Sarcocystidae ,Subfamily Sarcocystinae ,Genus *Sarcocystis* ,Species *Sarcocystis felis*(Lankester ,1882).Within the genus *Sarcocystis* several species parasitize cats and or dogs as definitive hosts .The fecal stages ,so –called sporocysts ,are morphologically indistinguishable and differentiation is based on tissue cyst morphology in the different intermediate hosts(omnivorous or herbivorous animals)and experimentally ,on molecular methods.

1.5 Diagnosis of Internal parasites in cats

1.5.1 Stool samples

Detection of the presence of the cysts of various parasites such as *Giardia* and *Cryptosporidium* ,the eggs of other parasites such as round worms, hookworms ,and tape worms ,can be found in stool samples .larval or adult worms or tape worms segments may also be observed(**Cringolli *et al.***) .

1.5.1.1 Direct smear fecal Exam

Small amount of faeces is placed on the microscopic slide with few drops of water and mixed and covered with slide slip for detection of eggs and other cysts Ref

1.5.1.2(Zink sulphate) Direct centrifugal flotation method

1-fill a 15 ml centrifugal tube with ZnSo₄ solution (1.18 specific gravity) 1 and pour into a glass dish or plastic specimen cup .

2-using a tongue depressor ,push the feces (2 to 5 grams ,a piece the size of a large grape) through the strainer into the ZnSo₄ solution in the dish .TIPS :
1,the sieve must be in the liquid in order for the feces to be passed through
2.the more feces you use ,the more likely you will be able to find eggs which are present in low number .

3-using a funnel ,pour the ZnSo₄ –fecal mixture back into the centrifuge tube.

4-centrifuge for 2 min at high speed (1500-2000rpm)

5-using headed –rod or loop ,remove a sample from the surface of the solution and place on a microscope slide (make 2 to 3 dips with the rod or loop to get enough material to examine ,you want the equivalent of large drop on the

slide add a drop of iodine (to stain the cyst and ova)and a coverslip .examine at 10X and then part of slide at 40X .

TIP: To increase the sensitivity of this technique either use more feces or do the following:

After removing the tube from the centrifuge ,fill the tube with ZnSo₄ to just over the top of the tube ,place a cover slip over the top of the tube and wait 10 min.place a drop of iodine on a slide and place the cover slip onto the drop of iodine and examine at 10X.this modification also allow you to skip using the loop or headed to obtain your sample ,and thus may be easier to do at a veterinary practice ,or place a cover slip on the tube before centrifuging .

TIP:If the sample contains large amount of fat or other material that floats in water ,you may want to wash the sample before doing the flotation .to do this ,start at step 1 but use water instead of ZnSo₄ .when you centrifuge the water –fecal mixture ,the eggs ,being heavier than water ,will sink but the fat and other material will float . after centrifugation pour off the supernatant ,add the ZnSO₄ solution and mixed well .centrifuge as in step 4 and examines as in step 5 .or use the ethyle acetate sedimentation technique to get rid of fat .

1.5.1.3 Ethyl acetate sedimentation (for fat extraction prior to ZnSO₄ centrifugal flotation)

1-pass a grape size piece of feces through a sieve in to about 9 ml of water and pour into a 15 ml centrifuge tube.

2-add about 3 ml of ethyl acetate ,plug the tube with a rubber stopper and shake the tube vigorously .caution :test material before placing ethyl acetate into them .this solvent will dissolve many types of plastic ,the white plastic centrifuge tubes used in the lab are ok,but clear hard plastic tube and the disposable polystyrene cups will dissolve .

3-remove the rubber stopper and centrifuge the tube (1500-2500 rpm)for 1 to 2 minutes.

4-using a stick ,ring the plug of the fat at the water –ethyl acetate interface (the plug adheres to the side of the tube and must be detached before the liquid contents of the tube can be poured off).

5-pour off the supernatant , being careful to leave the pellet at the bottom of the tube intact ,(flush the ethyl acetate down the sink with plenty of water).

6.resuspend the pellet in distilled water ,centrifuge ,then pour off the water (this remove any leftover fat and ethyl acetate).re suspend the pellet in flotation solution ,centrifuge again and remove the material from the top of the float examine for eggs (see Znso₄ ,technique). When remove from centrifuge , your tube will clearly defined layer:

- A. an ethyle acetate layer on top .
- B. A plug of dissolved fat in the middle .
- C. A layer of water .
- D. A pellet of sediment in the bottom.

1.5.1.4 The Baerman Technique

Veterinarian use this method for the extraction of live larval stages of nematode parasite from feces .

Technique (modified for use in the office lab)

1-place a sieve in a custard dish or other similar container .

2-spread about 10 gram of feces on a piece of tissue paper and place it into the sieve .

3-place warm *water in the custar dish until it just covers the feces ,taking care not to disrupt the feces .

4-allow to sit for at least one hour .

5-lift off sieve .

6-pour liquid into a 50 ml centrifuge tube .

7-let sit for 20 minutes.

8-using a pasture pipet remove a drop of the sediment at the bottom of the tube and place it on a microscope slide for examination ,(be careful not to resuspend the sediment before you take a sample from it .) *Use fresh feces – refrigeration may kill larvae *strongyloides stercoralis* this technique makes use of two characteristic of parasitic larval nematodes behavior . **

1-the warmer it is ,the more active the larva (up to point ,you don't want to cook them 37to 40 is as warm as you want to get)and in addition ,some larvae are thermotaxic and will move toward the warmer water under the filter paper .

2-most parasitic larval nematodes are poor swimmers. therefore ,the following events take place when the sieve is placed in the water.

The larvae will be moving around in a random fashion and within any given time interval some of them will migrate through the tissue and fall into the water .because they can't swim they sink to the bottom and over time a number accumulate there .the more active the larvae are (I,e the warmer the water)the greater the number of larvae that accumulate at the bottom in a given time interval *the longer you wait ,the more larvae will fall to the bottom of the dish ,,but with time ,the fecal sample breaks down and begins to pass through the tissue leading to an accumulation of sediment a long with the larvae .

1.5.1.5 Stool Egg counting technique

A method for determining the number of nematode eggs per gram of feces in order to estimate the worm burden in an animal. the advantage of this technique is that it requires no specialized equipment, the disadvantage is the counting takes a long time because of the amount of extra (non-egg) material on the slide.

1-weight out 3 grams of feces.

2-measure out 42 ml of water and place it into a dish, using a tongue depressor, push the 3 grams of feces through a sieve into the water, lift the sieve and hold over the dish, push out any remaining water from the feces.

3-while stirring the water –feces mixture, take 0.15 ml of the suspension and spread over 2 slides. cover each slide with a long coverslip (or 2 regular size coverslips).

4-examine both slides for worm eggs. the total number of eggs counted X100 represent the number of eggs per gram of feces.

5-the mathematics: **0.15ml** is $\frac{1}{300}$ of 45 ml (42ml water and 3gm feces) so the number of eggs in 0.15 ml X 100 is equal to $\frac{1}{3}$ of the total number of eggs in the original 3 grams and thus equal to eggs per gram (EPG).

1.5.1.6 McMaster Egg Counting Technique

This is another method for determining the number of nematode Egg per gram of feces in order to estimate the worm burden in an animal. the advantage of this method is it is quick as the egg are floated free of debris before counting, the disadvantage are you must use a special counting chamber and it has a detection limit of 100 EPG (unless multiple count are done on the same sample or more feces is added to the same volume of flotation solution).

1-weight out 2 grams of feces .

2.pass the feces through a sieve into a dish counting 60 ml of ZnSo₄ or satiated salt solution .lift the sieve and hold over the dish .push out any remaining solution from the feces .

3-while mixing vigorously (you may want to put the solution into a flask to prevent spillage) take a sample of mixture with a pipette and transfer it to one of the chamber of McMaster slide ,-repeat the procedure and fill the other chamber .

4-wait 30 sec,then count the total number of eggs under both of the etched areas on the slide ,use your 10X objective (first check to see that this objective can be swung into place without hitting the slide ,if it hits the slide ,count with the 40X lens).focus first on the etched lines of the grid ,then go down a tiny bit ,the eggs will be floating just below the top of the chamber .

Multiply the total number of eggs in the 2 chamber by 100 ,this is the eggs per gram (EPG)

5- **The mathematics** : the volume under the etched area of each chamber is 0.15 ml (the etched area is 1cm X1cm and the chamber is 0.15 cm deep so the total volume examined is 0.3 ml ,this is 1/200 of 60 ml ,since you started with 2 gms of feces and then multiplied by 100 ,the final result is eggs per gram of feces .

1.5.1.7Modified Wisconsin Sugar Flotation Method

This method of determining the EPG is probably the most commonly used method .(first used by the university of Wisconsin parasitology laboratory ,it is a modification of the stool technique it is the most accurate as it counts all the eggs in 3 grams of feces and because it is a flotation method it has little

debris to interfere with the count .however ,if the EPG is high, there may be too many eggs to count .

1-Fill a 15 ml test tube with 10 ml of sheather* s solution.

2-weight 3 grams of feces and place into a cup.

3- pour the sheather *s solution from the test tube into the cup and mix well .

4-place a funnel into the test tube ,place a strainer into the funnel and pour the fecal –sugar solution mixture through the strainer into the test tube .using a tongue depressor ,squeeze the liquid out of the feces that is left in the strainer.

5-centrifuge the tube for 2 to 4 minutes .

6- fill the tube to just over the top with more sheather s solution and place a cover slip onto the meniscus .

7.let sit for about 5 minutes ,then remove the cover slip and place on a slide .

8-examine the entire cover slip and count the number of eggs that you find .

9-the number of eggs counted is the number per 3 gram of feces ,so divide by 3 to find the EPG .

Sheather's solution : add 454 gm (1lb)of table sugar to 355 ml of very hot water .stir until dissolved and allow to cool ,this solution will grow mold if left out so keep refrigerated and use quickly .some people add 6 ml formaldehyde to the solution to preserve it .

1.5.2 Blood Examination

Collected for two basic parasitological procedures:

1-**smear** –to detect protozoal and rickettsial infection (*Trypanosoma* ,*Babesia* ,*Anaplasma*).smears must be fixed and stained to reveal organisms.

2-concentration –to detect microfilaria (i.e *Dirofilaria* and *Dipetalonema*).

If blood is not to be processed immediately upon removal from the patient , an anticoagulant must be added to the sample .among those commonly used :

- a. Heparin –effect lasts only for a matter of hours .
- b. EDTA –effect lasts several days .

1.5.2.1 Procedure for making blood smears (thin films)

- a. clean slide by wiping with alcohol .handle slides by edges only (any grease on the slide will cause the dried blood to flake off during staining).
- b. place a very small drop of blood near the end of the slide .
- c .place the end of another slide (the spreader)on the sample slide so that the edge of the spreader is just ahead of the drop of blood .
- d. holding the spreader at an angle of about 30(relative to the sample slide),draw it back until its edge just touches the drop of blood .the blood will then run along the entire edge of the spreader slide .
- e. push the spreader briskly in one fluid motion completely across the sample slide note that the blood is being dragged behind the spreader ,not pushed in front of it .
- f. if the correct amount of blood was applied ,the smear should end before the end of the slide ,and the smear should end in a feathered edge a region where the blood cell are well separated .
- g. Air dry .
- h. fixation and staining –various method can be used ,normally a commercial stained kit is utilized following the manufacturers instruction .

1.5.2.2 Procedures for concentration of blood (knott and filter tests):

there are several reasons for using one of the concentration techniques in the laboratory examination of dog blood for microfilariae .probably the main reason for using a concentration vs .the direct smear is that more 25 % of the positive cases may be missed if the direct smear is the only method used .secondly ,a concentration method that kills the microfilariae allows easy differentiation between *Dirofilaria immitis* and *Dipetalonema reconditum* .also ,keep in mind that certain anthelmintics can kill heartworm microfilariae in a way that may lead to the death of an infected dog or cat and thus you must be sure the dog is microfilariae free (not just Ag negativ e)before treating the animal with these drugs. The two acceptable concentration methods most commonly employed in practioners laboratories (Knott, 1939).

1.5.2.3 A.Modified Knott Method (also known as the knott test)

1-add 1 ml freshly –drawn blood to 9 ml 2% formalin (aqueous) in a centrifuge tube.

2-Mix well to lyses red blood cell .

3-centrifuge for 5 minutes at 1500 rpm.

4-pour off supernatant fluid .Note : invert the tube completely when decanting the supernatant .remember ,the blood sample you are using is dillute so you won't see large pellet.

5-add a drop of 0.1 % aqueous methylene blue .(Adjust the mount to suit yourself :it stains the microfilariae blue and makes them much easier to see.)then stir or mix up the sediment in the bottom of the tube .

6-mix again and place a drop of the stained mixture on a microscope slide and add a cover slip .

7-examine under microscope.

Note : As a further modification ,a microfilariae count can be made if a measured amount of the stained mixture is counted .Although it is only a generality ,*D.immitis* microfilariae are often characterized by having high concentration of microfilariae ,whereas *D.reconditum* microfilariae are often found in low concentration .

1.5.2.4 Filtration method

1-collect a 1ml blood sample into EDTA or heparin and add to 10 ml lysing solution within a syringe .mix thoroughly .(lysing solution consists of 0.5 ml Trion x-100,8.0 grams Na_2CO_3 ,1liter water)

2.Attach syringe to a filter unit (see drawing).the lysed blood solution is pushed through an 8mM pore filter membrane .3.Remove the filter from the filter holder ,place it on a microscope slide and add one drop of 1:10:000 methylene blue stain .cover filter with a cover glass and examine under microscope.

1.5.2.5 Miscellaneous methods

It is frequently difficult to distinguish microfilariae of *D.immitis* from microfilariae of *D.reconditum* using the morphological characteristics outlined above .more definitive techniques for differentiation are available , but they are not usually practiced for routine use in the practitioner's laboratory .The first technique employs a histochemical (acid phosphate) stain of microfilariae .*D.immitis* stain positive in certain zones only and *D.reconditum* stain over the entire microfilariae. The second technique exploits the fact that *D.reconditum* microfilariae have a cephalic hook and *D.immitis* microfilariae do not .,since this technique requires good microscopic capability ,it may not be suited for routine use

1.6 Control and prevention of internal parasites in cats

1.6.1 Cestodes prevention and control in cats

The deworming medication called anthelmintic may be given as a tablet or an injection for prevention of cestodes in cats. Flea control is the cornerstone of prevention of cestodes in cats (*Dipylidium caninum* infection). removal and disposal of all pet feces properly, especially in public parks, yards, or playgrounds. teaching and practice hygiene practice for children after playing outdoor. stopping of cat from eating preys like infected mice, birds, rabbit (taenia infection) Ref

1.6.2 Trematodes prevention and control in cats

Prevention of predation and scavenging activity by confining dogs and cats in a fenced yard and keeping cats indoors will limit the opportunity for cats and dogs to acquire infection with trematodes. To avoid trematodes infection dogs and cats should not have contact with water through such activities as swimming in canals or ponds. Also giving a dog or cat undercooked fishes or frogs. For controlling routine deworming of dog or cat every 3 months.

1.6.3 Nematodes prevention and control in cats

Keeping cats indoors and dogs confined to a leash or in a fenced yard will limit the opportunity for pets to acquire nematodes or paratenic hosts. Also do not feed dogs or cats raw or undercooked frogs or fish also the refuse from cleaning fish should be secured to prevent scavenging behavior. Deworming is most effective in preventing of nematodes in pets dogs and cats every 3 months. Cleaning up pet feces regularly, will reduce environmental contamination with infective parasite stages. Dogs and cats should not be allowed access to rodents, carcasses or placenta and aborted fetuses of cattle and sheep. they should also be provided with fresh, potable water.

1.6.4 Prevention and control of protozoa in cats

All the protozoa of cats infect predominantly young animals such as kittens and puppies ,older animals are mostly immune after previous infections and seldom show signs of disease ,with the exceptions of geriatric ,chronically sick or immune –compromised animals and perhaps pregnant animals ,old animals ,however may still be a source of infection and thus pass on infection to their offspring ,health status and background of the animal have to be considered .cleaning up pet feces regularly and drying of surface of kennels, will reduce environmental contamination with infective parasite stages,control of vectors (kissing bugs)by used of insecticides and euthanizedtheinfected animals with *T.cruzi*,keep cats in door during ticks season and used of Acaricides to avoid ticks. Preventing dogs and cats from eating rodents and raw meat,transmitted directly ,for example ,*Giardia* ,*Trichomonas* ,*Cryptosporidium* ,*Cystoisospora* ,and these may require special consideration .Access to the outdoor may also influence the risk of infection . Cats and dogs with access to rodents and raw meat , including viscera and foetal or placenta material ,may be at risk of acquiring infection with cyst –forming coccidia ,*Neospora* ,*Hammondia*,*Toxoplasma* ,and *Sarcocystis* .

1.7 Treatment of internal parasites in cats

1.7.1 Treatment of cestodes in cats

Effective deworming medication which will kill the tapeworms ,these may be in tablet ,injection or spot on from usually we give the first dose and after 2 weeks repeat the dose this for tablets treatment .Once they have died ,they will be digested along with the cat food .Common tapeworm medication include praziquantel in dose 7.5mg/kg mebendazole in dose 11mg/kg. Cat and the environment will need to be treated for fleas at the same time .all bedding should be washed in hot water ,all pets in the household should be treated for

both tapeworm and fleas .Usually the active ingredients oxantel and pyrantel also praziquantel as well as fenbendazole are more effective against cestodes in cats .

1.7.2 Treatment of Trematodes in cats

If your cat is severely ill, with trematodes infestation it will need to be hospitalized so that it can be fed and hydrated intravenously. Vitamin D will be administered in cases of liver flukes and Antibiotics may be required for preventing opportunistic infections, used of praziquantel as the drug of choice in dose 5 to 20 mg/kg weekly usually effective in treatment of trematodes in cats .

1.7.3 Treatment of nematodes in cates

Effective deworming medication which will kill the Nematodes, these may be in tablet, injection or drenchas the first dose and after 2 weeks it must repeat the dose this for tablets treatment .once they have died, they will be digested along with the cat food .Common Nematodes medication include fenbendazole in dose 50mg/kg, selamectin in dose 6mg/kg as well as ivermectin in dose 0.024mg/kg.

1.7.4 Treatment of Protozoa in cats

Usually the prevention and control used ,fecal removal and incineration cleaning of yard from fecal material is effective ,avoid give raw meat (beef, pork) to cats and raw goats milk ,giving of Clindamycin in dose 5.5mg/kg-22mg/kg, Trimethoprim with Sulphadiazine in dose 15-30mg/kg) for *T.gondii*, *I.felis* , ,as well as Ronidazole in dose 30mg/kg for *T.Foetus* ,sulphanomides also used and fluids therapy and symptomatic treatment.

1.8 Prevalence and Risk factors of Internal and External Parasites in cats in Kuwait

Osama et al., (2015) investigated Trematodes in stray cats in Kuwait, A total of 240 stray cats were examined. About 59 (24.6%) cats were found to be infected with FZTs, and 23 (39.0%) being infected with more than 2 different species. Fourteen species of FZTs were recovered in the small intestine of cats. Among them, the great majority (11 spp.) were members of the family Heterophyidae, 2 species (*Mesostephanus dottrensi* and *M. appendiculatus*) were those of the Cyathocotylidae, and only 1 species, *Echinochasmus japonicus*, belonged to the Echinostomatidae. Three species of the genus *Heterophyes* (*H. heterophyes*, *H. dispar*, and *H. nocens*) were detected in 15.8%, 10.8%, and 2.9% of stray cats examined, and their average numbers were 141, 83, and 203 worms per cat infected, respectively. Trematodes including *Centrocestus* *cuspidatus*, *Galactosomum fregatae*, *Ascocotyle* sp., *M. appendiculatus*, *H. yokogawai*, and *Pygidiopsis genata* showed the lowest prevalence (0.4%) and intensity. (Abdou et al., 2013) investigated protozoa in stray cats Out of 240 fecal samples examined 22 (9.2%) were found to be infected with oocysts of four species of coccidian protozoa. *Isospora felis* was the most predominant enteric protozoan parasite (7.1%) followed by *T. gondii* (2.1%), *I. rivolta* (1.6%), *Sarcocystis* was only found in one case (0.4%). juvenile cats (6 months old) had higher infection rate with oocyst of enteric protozoa than the older cats (p-value 0.001). sero-survey of 240 stray cats revealed that 19.6% were positive to *T. gondii* IgG. *Toxoplasma* sero-positivity was observed in higher number of adult compared to young cats suggests that with age the risk of exposure to *T. gondii* increased. While concurrent retroviral infections were not found to be associated with increased risk for developing *T. gondii* antibodies.

Chapter Two

Materials and Methods

2.1 Study Area

Kuwait is a small country located 29°10'00"N 47°36'00"E in the desert geographical region ,because of the type of the climate and soil ,vegetation is extremely sparse The climate is continental characterized by its long dry hot season (April up to November)and mild cold wet season (December up to March).Dust storms often occur during long hot season and temperature sometimes reached 50°C . Animal House veterinary Hospital located in Hawally locality, block 8 nearby the sea the customers coming from different localities .

2.2 Sample Size

Total of 150 cats screened from the study area a random samples of cats collected monthly (with an objective of 10 to 20 cats per month) from clinical services in the study area .Client-owned cats eligible's for participation in the study provided that good health ,and will not present for a medical reason related to any parasitic disease ,cats should not had received an anthelmintic treatment for two months prior to inclusion.

2.3 Sampling Technique

A random samples of cats examined monthly in total of 10 to 15 cats per months for external parasites using parasite Comb Counting to detect the lice ,mites ,fleas ,ticks on the skin also the ear canal swabs was taken from all examined cats to detect the ear mites under microscope and skin scraping for suspected cases with skin mites. For internal parasites fecal samples collected from all cats to detect the adult parasites and cestodes proglottid, eggs, larvae ,oocyst ,cysts .

2.4 Questionnaire Survey

Information of each sampled cat was obtained, this included its age, gender, breed, type of cats food and hunting behavior .Selected cats owners were interviewed by using questionnaire and risk factors that had possible association with infestation with internal and external parasites in cats to support macroscopic examination. The facts were included contact with stray cats , breeding source of cat, from which locality the cat come from .

2.5 Diagnostic Techniques

2.5.1 Comb Counting

Cats were combed for at least 7 minutes and combing continued until no further parasites had been removed for 3 consecutive minutes. The collected fleas or ticks were stored in individual vials containing 60% ethanol for identification of species. The external ear canals of all cats were examined and cerumen samples were examed for microscopical search of *Otodectes* spp. Cats with suspected skin mite infestations were assessed by skin scraping (Euzeby, 1981).

2.5.2 Ear canal swab

Swab samples (150 swabes) were taken from ear canal of selected cats and placed on slide and mixed with mineral oil and cover with covered slip and examined by microscope lens 10x and lens 40x to detect the ear mites .

2.5.3 Skin scraping

The infected lesions were scraped to confirm the presence of skin mites or fungal infection by microscopic examination (Soulsby, 1982).

2.5.4 Direct Centrifugal Flotation technique

Gastrointestinal parasites were detected with a centrifugal flotation technique employing a flotation solution of saturated salt and 500 g/l sugar (specific

gravity 1.28). Feces from each of the three samples, totally between 3 and 5 g, were dissolved in the flotation solution, passed through a sieve (150 μ m aperture), transferred to a Clayton-Lane centrifuge 15 ml tube. A glass coverslip 18 \times 18 mm was placed on the tube that was then centrifuged at 214 \times g for 5 min in a Thermo Fisher Scientific—Sorvall ST40 centrifuge (Life Technologies Europe BV, Stockholm, Sweden) equipped with a swing out rotor (Soulsby; 1982 Anon,1986). After centrifugation, the coverslip was transferred to a microscope slide and examined for parasites at a magnification of 100–400 \times by one of two experienced biomedical scientists. A minimum of 10 fields were carefully examined at 400 \times . The reading was done in a blinded fashion, i.e. without any information about the cats. Results were recorded semi-quantitatively as follows: no, few, low number, moderate number, high number and very high number of eggs/oocysts.

2.6 Statistical Analysis

Data in questionnaire were stored in Statistical Package for Social science (SPSS),(IBM, SPSS, Statistic version 22.0 for windows).Prevalence rates were recorded as the ratio of the number of positive animals to the total number of examined animal's .The 95%confidence intervals were computed with SPSS software. Crosstabulation was used to measure the degree of association between parasitism and risk factors first screen in univariate analysis using the Chi-square. Potential risk factors with $P < 0.05$ were considered significant at this level and then by multivariate analysis with binary logistic multiple-regression.

Chapter three

Results

3.1 prevalence rates of Internal and external parasites detected in the study

All samples 150 cats included in this study were negative from ticks, lice, fleas as well as skin mites. Ear swab examination identified 27 (18%) cats were infected by ear mites *Otodectes cynotis* (Table 1). While the prevalence rate of *O.cynotis* among males and females was 21.95% and 13.23% respectively. The prevalence rate of *O.cynotis* among males and females were significantly different ($P < 0.05$) . Direct centrifugal flotation identified 33 cats were infected by *Ancylostoma tubaeforme*(larval stages in fecal samples) and the prevalence rate from total cats examined was 22%.The prevalence rate of *A.tubaeforme* among male and female was 20.7% and 23.5% respectively .There was no statistical difference ($P > 0.05$) between the prevalence rate among male and female. Whereas 11 cats infected by cysts of *Isospora felis* from total cats examined and the prevalence rate was 7.33%.The prevalence rate of *Isospora felis* among male and female was 8.54% and 5.88% respectively. But there was significant difference($P < 0.05$) between them (Table 1) .

Table 1: Prevalence rate of external and internal parasites infected cats (150) in Salmiya– Kuwait

Specie	Male	Female	Significant
<i>Otodectes cynotis</i>			
No. examine	82	68	
No. Postive	18 (21.95%)	9 (13.33%)	0.005**
<i>Ancylostoma tubaeforme</i>			
No. examine	82	68	
No. Positives	16 (20.73%)	17 (23.5%)	ND
<i>Isospora felis</i>			
No. examine	82	68	
No. Positives	7 (8.54%)	4 (5.88%)	0.04**

3.2 Parasitism prevalence in relationship to risk factors

3.2.1 Age Groups

In the crosstabulation the prevalence rate of *O.cynotis* (ear mites) at different age groups was 29.17% in group 1 less than 3 months, and 27.08% in group 2 less than 6 months, 9.23% in group 3 less than 1 year and 7.69% in group 4 over one year. The majority of infected cats by *O.cynotis* were kittens (Table 2.) less than 6 months ($P > 0.05$). The prevalence rate of *A.tubaeforme* at different age groups was 0% in group 1 less than 3 months and 22.92% in group 2 less than 6 months, and 29.23% in group 3 less than 1 year and 23.08% in group 4 over 1 year. The majority of infected cats with *A.tubaeforme* were cats (Table 2) over 3 months, there was a significant difference between infection with *A.tubaeforme* and age group ($P < 0.05$). The prevalence rate of *I. felis* at different age groups was 37.5% in group 1 less than 3 months, and 2.08% in group 2 less than 6 months, 0% in group 3 less

than 1 year ,and 7.69% in group 4 over 1 year . The majority of infected cats (Table 2) with *I.felis* were kitten under 6 months($P>0.05$).

Table 2: Prevalence rate of the age of infected cats (150) by external and internal parasites in Salmiya– Kuwait

Age	Species	Positive	Negative	Prevalence rate
	<i>Isospora felis</i>			
Less than 3 months		9	15	37.5%
Less than 6 months		1	47	2.08%
Less than 1 year		0	65	0%
Over 1year old		1	12	7.69%
total		11	139	7.33%
	<i>Ancylostoma tubaeforme</i>			
Less than 3 months		0	24	0%
Less than 6 months		11	37	22.92%
Less than 1 year		19	46	29.23%
Over 1year old		3	10	23.08%
total		33	117	22%
	<i>Otodectes cynotis</i>			
Less than 3 months		7	17	29.17%
Less than 6 months		13	35	27.08%
Less than 1 year		6	59	9.23%
Over 1year old		1	12	7.69%
total		27	123	18%

3.2.2 Localities

the prevalence rate of *I.felis* at different localities was 7.9% from Hawally locality ,and 12.5% from Alasema locality and 0% from the rest localities(Alferwania,Alahmady ,Algahra, Mobark alkaber).All cats infected with *I.felis* came from Hawally and Alasema localities , and the majority came from Hawally locality (9/127), 7.09%.The high prevalence rate from Alasema locality(2/16,12.5%) ($P>0.05$) Table (Table 3). The prevalence rate of *O.cynotis* at different localities was(25/127) 19.69% from Hawally locality ,and(1/2)50% from Alahmady locality ,and (1/5)20% from Alferwania locality and 0% from the rest localities .The high prevalence rate of *O.cynotis* was in Alahmady locality (1/2,50%) ($P>0.05$) (Table 3).the prevalence rate of *A.tubaeforme* at different localities was(29/127) 22.83% from Hawally locality and(1/16) 6.25% from Alasema and(3/5) 60% from Alferwania and 0% from the rest localities .The high prevalence rate was in Alferwania locality($P>0.05$) (Table 3).

the 05 3Table 3 Prevalence rate of the cats (150) suspected by external and internal
parasites in in some localities in Kuwait

Locality	species	Positive	negative	Prevalence rate
	<i>Isospora felis</i>			
Hawally		9	118	7.09%
Alasema		2	14	12.5%
Alahmady		0	2	0%
Alferwania		0	5	0%
Total		11	139	7.33
	<i>Otodectes cynotis</i>			
Hawally		25	102	19.69%
Alasema		0	16	0%
Alahmady		1	1	50.00%
Alferwania		1	4	20.00%
Total		27	123	18%
	<i>Ancylostoma tubaeforme</i>			
Hawally		29	98	22.83%
Alasema		1	15	6.25%
Alahmady		0	2	0%
Alferwania		3	2	60.00%
Total		33	117	22%

3.2.3 Source of the cat

The prevalence rate of *A.tubaeforme* at different sources of cats was 0% from house breeding source and 26/106, 24.53% from pet shops , 4/23, 17.39% from another breeder ,1/5, 20% from the street and 2/8, 25% from the adoption societies .The high prevalence rate (25%) (Table 4) was from the adoption society's source and the majority of infected cats came from pet shops source. The prevalence rate of *I.felis* at different sources of cats was 0% from house breeding source, and (3/106,2.83%)from pet shops, and (7/23)30.43%from another breeder, and (1/5)20% from the street, and 0% from the adoption societies. The high prevalence rate of *I.felis* was from another breeder source (Table1.4). The prevalence rate of *O.cynotis* at different sources of cats was (1/7, 14.23%) from house breeding, and (19/106,17.92%)from pet shops, and (4/23,17.39%) from another breeder,(2/5,40%) from the street ,and (1/8,12.5%) from the adoption societies .so the majority of infected cats came from pet shops source and high prevalence rate of *O.cynotis* was from street source (Table 4) .

Table 4: Prevalence rate of the source of suspected the cats (150) by external and internal parasites in Salmiya– Kuwait

Source of cat	<i>Isospora felis</i> N (%)	<i>Otodectes cynotis</i> N(%)	<i>A.tubaeforme</i> N(%)
Breeding house	0 (0.00%)	1 (14.23%)	0(0.00%)
Pet shop	3 (2.83%)	19 (17.92%)	26(24.53%)
Another breeder	7 (30.43%)	4 (17.39%)	4(17.39%)
The street	1 (20.00%)	2 (40.00%)	1(20%)
Adoption societies	0 (0.00%)	1 (12.50%)	2(25%)
Total	11 (7.33%)	27 (18.00%)	33(22%)

3.2.4 Contact with stray cats in Salmiya- Kuwait

Two cats contact with stray cats from all cats examined. One cat infected by *A.tubaeforme* contact with stray cats and prevalence rate was 1/33, 3.03% and there is no significant difference between the prevalence rate (table 5) among contact with stray and worm larval stages in fecal samples ($P>0.05$).

Table 5: Prevalence rate larval stages in suspected cats (150) in Salmiya– Kuwait

	Contact with stray cats		Prevalence rate
	Yes	No	
Larval detected	1	32	3.03%
Larval not detected	1	116	0.85%
Total	2	148	1.33%

3.3 Logistic Regression

In logistic regression and the condition Index for infection with larval stages of *A.tubaeforme* was 16.692(15>condition Index) and, condition Index of infection with cyst of *I.felis* was 44.148 (15>condition index) where as 84 % variance proportion. Because of this there were correlation between the age of infected cats and parasitism .

Chapter four

Discussion

Infestation by internal and external parasites may cause varying clinical signs in cats ,from mild gastro-intestinal disorders and failure to thrive, anemia or anorexia in the more severe cases ,particularly in kittens with heavy parasitic burdens(Traversa ,2012).In addition some parasites of cats have a zoonotic potential ,either through close contact with parasitized animals or through exposure to a contaminated environment (Raether and Hanel ,2003; Petavy *et al.*,2000). This is the case for some nematodes such as *Toxocara cati* and *Ancylostoma tubaeformae* ,which are responsible for human visceral /ocular and cutaneous larva migrans, respectively (Fisher, 2003; Robertson and Thompson , 2002). Humans may also become infested with zoonotic cestodes from cats such as *Dipylidium caninum* or *Echinococcus multilocularis* (Deplazes *et al.*,2011; Petavy *et al.*, 2000). Amongst protozoan ,*Toxoplasma gondii* is major importance in public health ,nevertheless ,it is recognized that the main source of infection for humans is consumption of meat and less to oocysts(Lopes *et al.*, 2008; Schares *et al.*,2008) . Ectoparasites can cause direct damage when infesting pets, such as discomfort ,pruritus and allergic reactions,but they have also a potential vectorial role for instance fleas are involved in the transmission of dog tapeworm *D.caninum* and zoonotic pathogens ,especially *Bartonella henselae* ,the causative agent of cat-scratch disease (Beugent and Marie,2009;Euzéby ,1981) . In this study the prevalence rate of *A..tubaeforme* was high (22%) ,the life cycle of this zoonotic hookworm is direct, all cats included in this study were domestic indoor cats and this offered suitable temperature and humidity to the larvae compared with the previous studies of the stray cats in Kuwait that reported low prevalence rate (1.3%) (Abdul-salam and Baker,1990) due to ambient temperature and humidity on the street . Hookworm recorded in Kuwait was

A.caninum in stray dogs (Matthews,1985)and cats(Abdul-salam , 1986) with low prevalence rate 2.9% and 0.48% ,respectively . In this study the prevalence rate of Ear mites (*O.cynotis*)was high (18%). This parasite transmitted by direct contact and the infection occurred to these cats in the shops due to crowding 26(24.53%) the crowded increased the chances of infection by direct contact. . Kittens less than 3 months (7, 29.17%) and less than 6 months (13, 27.08%) infected more than adult cats over 6 months due to weak immunity against ear mites. In this study the prevalence rate of cysts of *I.felis* was 7.3% ,this result was in accordance with that recorded in stray cat 7.1% in Kuwait (Abdou *et al.*, 2013). This internal parasite transmitted by direct contact with fecal from infected cats especially from infected mother to her kittens and the majority of infected cats in this study were kitten less than 3 months (9,37.5%) and kittens less than 6 months (1,2.08%).Crowding and poor management play big role in transmission of this parasite. Logistic regression showed that there were correlation between the age of infected cats and infections with *I.felis* (44.148) and *A.tubaeforme* (16.692). This study reveals that domestic indoor cats can act as reservoir hosts for zoonotic parasite *A.tubaeforme* and causative agent of cutaneous larva migrans (creeping eruption) in human.

Conclusion

The current study showed high prevalence rate 22% of hookworm (*Ancylostoma tubaeforme*) this means owners and family members are at risk due to direct life cycle of this zoonotic worm.the multivariate analysis shown there were association between age of infected cats and infections with *I.felis* and *A.tubaeforme* .Results of the present study clarified the status of external and internal parasites in infected domestic cats (*felis catus*) visiting Animal House Veterinary Hospital in Kuwait city and the risk factors that contribute

to the parasitism as well as the possible zoonotic impact for owners and family members

Recommendations

1. Deworming of indoor cats every 3 months playing very important role in control and prevention of internal parasites and zoonotic worms .
2. Avoiding to keep large numbers of cats in one place, good hygienic practices like washing hands after playing with cat and using of gloves for removal of fecal material is very important in controlling and prevention of internal worms and protozoa transmitted from cats to human.
3. Checking indoor cats every 3 months with your veterinarian for ear mites and treating all pets cats and dogs in the house by ear drops for at least 3 weeks for infected cats.
4. Keeping food and water away from fecal material of cats .
5. Keeping children away from places where stray cats defecated and litter box must be used.
6. Regular vaccination of kitten in eight weeks of age increasing the immunity against bacterial ,viral and parasitic diseases .

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Appendix

Questionnaire

Study of Internal and External Parasites in cat (Felis catus)

In Animal House Veterinary Hospital Salimya region, Kuwait

Owner name.....

Tel No.....

pet name

Species of animal:

1-cat ()

Age of cat2-

1-lees than 3months () 2-less than 6 months () 3-lees than 1 year () 4-
more than 1 year ()

breed of animal 3-

1- persian () 2-himalayan () 3- siamese () 4- street breed () 5- other
breed ()

4-sex of cat

1-male () 2- female ()

5- Reasons of visiting the clinic

1-gastrointeritis () 2- pneumonia () 3- Ear mites () 4- Other ()

6-signs of illness

1-diarrhoea () 2- nasal discharge () 3- fever () 4- Anorexia () 5- others

7- Housing of the cat

1-indoor () 2- out door ()

8- contact with stray cats

1- yes () 2- no ()

9-is the animal infected by internal or external parasites before

1- yes () 2- no ()

10- if yes what the treatment used

1-Anthelmintic () 2-Insecticides spray or shampoo () 3-Ear drop for mites ()

11- type of cat food

1- cans for cats () 2- dry food for cats () 3- House food () 4- Other food

12- Animal litter

1- cats artificial sand () 2- natural sand () 3-other

13- Giving vaccines for animal

1-yes () 2- no ()

14-is the cat received Anthilmentic before

1-yes () 2- no ()

15-is the cat bathed with Antifleas & lice shampoos before

1-yes() 2- no ()

16-typt of External parasites on the cat skin

6- none () 1-ticks () 2-lice () 3-fleas () 4- ear mites () 5- skin mites ()

17-condition of the skin

1-normal () 2-alopacia () 3-wounds () 4- redness ()

18- ear swap for ear mites

1- ()negative () 2-positive

19-fecal sample textures

1-liquid () 2-firm () 3-hard ()

20-fecal sample color

1-yellow () 2-brown () 3-black () 4-other ()

21-macroscopic examination of fecal sample find out

1-worms () 2-blood () 3-mucus () 4-foreign bodies () 5-normal

Parasites Microscopic examination E xternal

22-Ear mites

1-detected () 2-not detected ()

Classification if visible

.....

23-lice

1-detected () 2- not detected ()

Classification if visible

.....

24- fleas

1-detected () 2-not detected ()

Classification if visible

.....

25- ticks

1- detected () 2- not detected()

Classification if visible

.....

Internal parasites microscopic examination

26-Adult worms

1- detected () 2- not detected

Classification if visible

.....

27-worms eggs

1-detected () 2-not detected ()

Classification if visible

.....

28-worms larvae

1-detected () 2- not detected

Classification if visible

.....

29-cyst of Isospora felis

1-visible () 2- not visible ()

Classification if visible

.....

30- treatment of positive cases

.....

.....

.....

.....

.....

31-result after treatment

1-positive () 2- negative ()

32 – from which locality the cat come from

1-Hawally () 2-Alasama () 3-Alahmady() 4-Alfrwania() 5-Algahra() 6-
Mobark Alkaber()

33-source of cat

1-house breeding () 2-pets shop () 3- other breeder () 4-street () 5- adoption
from animal centers ()