AL-TAHADI UNIVERSITY
FACULTY OF SCIENCE
DEPARTMENT OF ZOOLOGY

PREVALENCE AND MORPHOLOGICAL STUDIES ON THE LARVAL CYSTS OF *ECHINOCOCCUS GRANULOSUS* (BATSCH , 1786) IN HERBIVORUS ANIMALS IN SIRT-LIBYA

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science.

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بسم الله الرحمن الرحيم

﴿ وما أوتيتم من العلم إلا قليلا ﴾

صدق الله العظيم

سورة الإسراء – الآية 85

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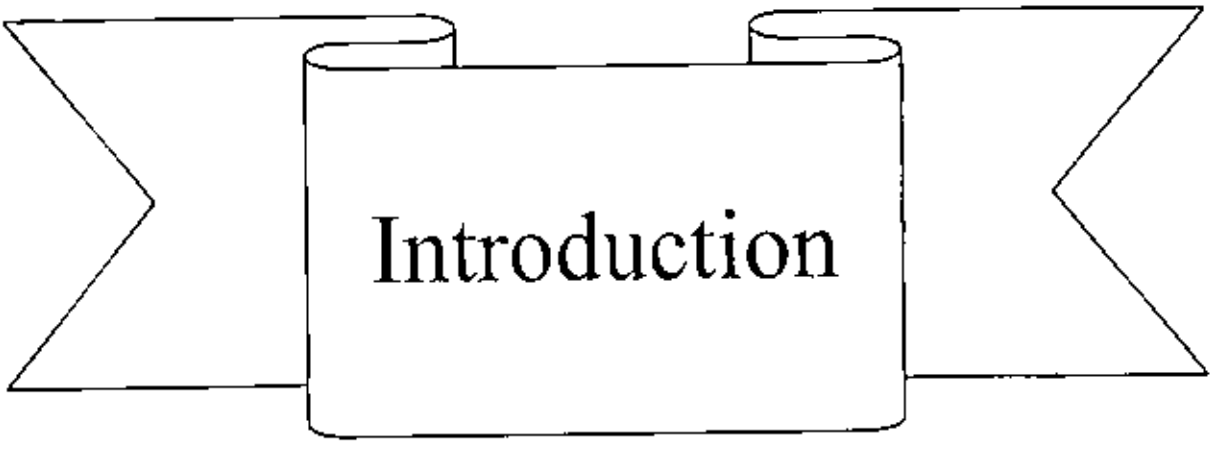

Introduction

1. INTRODUCTION

Hydatidosis is a widespread zoonotic disease infecting large number of animals and humans (Bouree , 2001) . It is caused by the larval stage for dogs and by eggs for humans and animals of any one of the four species of genus *Echinococcus* Rudolphi , 1801 . Those four species are *Echinococcus granulosus* (Batsch , 1786) , *Echinococcus multilocularis* (Leuckart , 1863) , *Echinococcus vogeli* (Rausch and Bernstein , 1972) and *Echinococcus oligarthrus* (Diesing , 1963) (Thompson and Lymbery, 1988) . The latter two species are rare infections are confined to Central and South America . The taxonomy of four species of genus *Echinococcus* was based on (1) morphological variations alone and (2) mitochondrial DNA sequencing showed these species to be genetically distinct (Bowles *et al* , 1992) . The life cycle patterns and distribution of these four species was reviewed by Rausch (1995) .

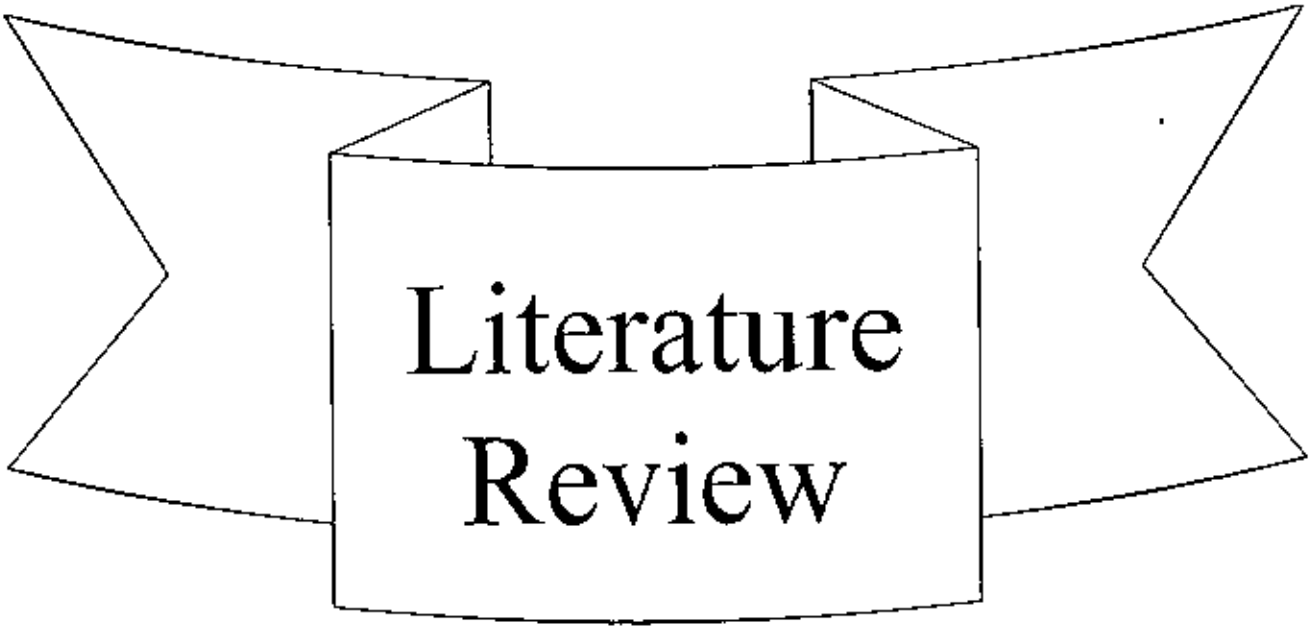
Adult *Echinococcus* spp. are small , true tapeworms belonging to the class Cestoda within the phylum platyhelminths . Subfamily Echinococcinae (Thompson , 1995 ; Rausch , 1997) . They have a characteristic features of order cyclophyllidea . *Echinococcus* spp. are obligatory parasites of mammals requiring two hosts to complete their life cycle . Both adult and larval stages of these species are morphologically and biologically dissimilar .

Hydatidosis has been reported in both urban and rural communities where dog , the main definitive host , have been access to raw offal through home-slaughter from poorly regulated abattoirs or from scavenging carcasses or discarded offal (Watson-Jones *et al* ., 1997) . Man can be infected by ingesting eggs from canine faeces on vegetables

or fruits or from handling dogs (Onah *et al* ., 1989) . In addition to economic importance , hydatidosis is a great threat to public health and many human cases require surgical interference (Haridy *et al.*, 2000) .

The prevalence rates of cystic hydatidosis in livestock are indicators of environmental transmission and potential risk for human (Ibrahem and Craig , 1998) . Hydatid disease is endemic in many animals raising countries particularly in Middle East , Mediterranean (FAO , 1993 ; Clavel *et al* ., 1999 and Erman *et al.*, 2001) , North Africa (Matossian *et al.*, 1977 and Gebreel *et al.*, 1983) . Hydatid disease appears to be endemic in Libya (Gebreel *et al.*, 1983) . However little work has been published in Libya (Dar and Taguri , 1978 ; Gebreel *et al.*, 1983 ; Kalani *et al.*, 1984 ; Gusbi , 1987 ; Gusbi *et al.*, 1987 ; Awan *et al.*, 1990 ; Shambesh *et al.*, 1992 , 1999 ; Khan and Kidwai , 1996 ; Khan and El-Buni , 1999 ; Tashani *et al.*, 2002 and Mohamed *et al.*, 2004) .

The aim of this study are (1) Determining the current prevalence of cystic echinococcosis in various domestic herbivorous animals slaughtered for human consumption in Sirt . (2) Study the morphological characters of larval stage of *Echinococcus granulosus* in these animals . (3) Analyse the different factors which may responsible for transmission and spread of the disease in Sirt . and (4) Analysis of obtained results using different statistical methods .


Literature
Review

2. LITERATURE REVIEW

2.1 Morphological characters of *E . granulosus* :

Adult worm : The adult parasites in the intestine of dogs represent one of the smallest tapeworms , with varying length between 3 and 9 mm and usually of only 3-5 proglottids , the scolex is globular in shape and has a prominent rostellum , armed with a double row of between 30 and 36 hooks (Saidi , 1976 ; Gutierrez , 1990 and Thompson and Mc Manus , 2002) . The eggs are very similar to those of the genus *Taenia* , and measure between 30 and 40 µm in diameter . The eggs are resistant to temperature ranging from 30 to 38 °C (Gemmel and Lawson , 1986 ; Thompson *et al.*, 1995) .An infected dog is known to be capable of sheeding about 120 million eggs per week (Morris and Richards , 1992) .

The metacestode (hydatids) : The term metacestode and hydatid cysts are used to describe the larval stage of all species of *Echinococcus* . Clinical and economical aspect of infection due to this stage (Thompson , 1995) . The hydatid cysts are large , roughly spherical , fluid filled hollow bladders , containing numerous protoscoleces (forming the so-called hydatid sand) , broad capsules and daughter cysts which are identical in form to their parent cyst . The cyst wall itself consists of an outer laminated hyaline wall , supporting the whole cyst . Beneath this there is a nucleated germinal layer , sudded with developing broad capsules , which may eventually break of to float freely in the fluid filled cyst . The protoscoleces are formed within the broad capsules , which may rupture to give the free protoscoleces in the hydatid fluid (Morris and Richards , 1992 and Muller , 2002) .

2.2 Life cycle patterns of *E. granulosus* in Libya :

The life cycle of *E. granulosus*is a domestic cycle (Fig . 1) , involving domestic dog as the definitive host for the adult worms and various species of livestock including sheep, goats , cattle , camels , buffaloes , pigs , horses and donkeys as intermediate hosts for the larval stage (El-Kordy , 1946 ; Dar and Taguri , 1978 , 1979 ; Larbaoui *et al.*, 1980 ; Gusbi *et al.*, 1987 ; Pandey *et al.*, 1988 ; Ahmed , 1991) .

Dogs are responsible for the contamination of the pasture with the infective eggs (Gusbi , 1987) . Various domesticated animals harbors the larval hydatid cyst stage (Gusbi *et al.*, 1990) . Human infection may acquired through the ingestion of eggs with vegetable or drinking water or through direct contact with dogs as in case of children (Gebreel *et al.*, 1983 and Shambesh *et al.* 1992) or through tending the herds of goats and sheep (Kalani *et al.*, 1984) . Fossati (1970) reported that human infection may acquired through inhalation of dust containing eggs , this may occurs because Libyan climate characteristic with " gibli " storm can assist in the inhalation of eggs with dust .

The eggs pass in the faeces of definitive hosts . After ingestion by the intermediate hosts , the eggs hatch in the small intestine and releases an onchosphere , that penetrates the intestinal wall , then migrates through circulatory system into various organs such as liver and lungs . In these organs the onchosphere develops into a cyst , which grow gradually and producing protoscoleces . The definitive host become infected by ingesting the infected organs . After ingestion the protoscoleces evaginate , then attach to the intestinal mucosa and develop into adult worm .

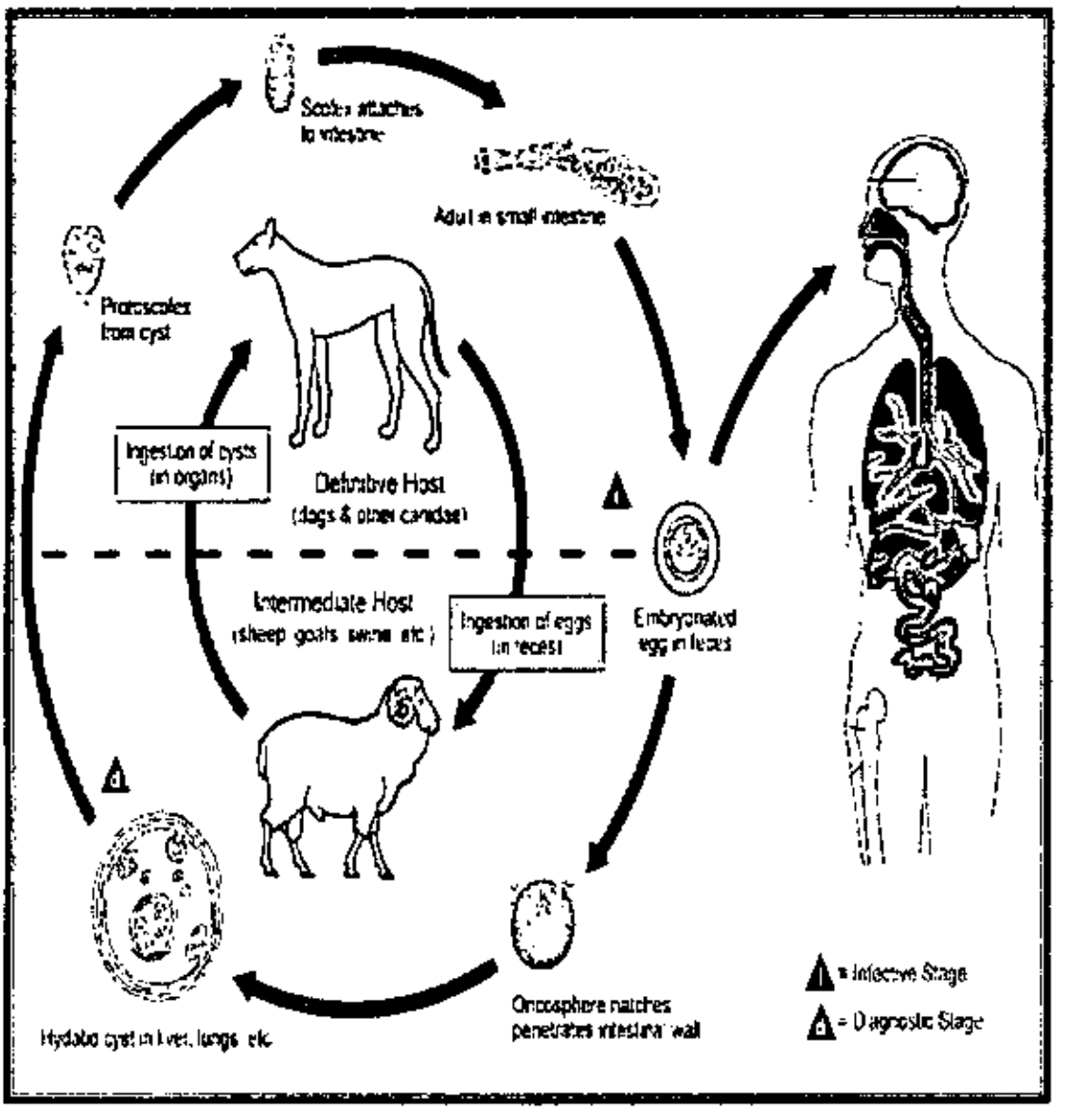


Figure 1 : Diagrammatic representation the life cycle of *E. granulosus* Indicate sheep-dog life cycle (Source : Parasites and health Echinococcosis , Last modified : 2003) .

The major differences in the life cycle of the four *Echinococcus* species are the nature of hosts involving (Rausch , 1997) . The adult worm tend to host-specific , whereas the metacestode larva stages are able to develop in large number of different mammalian hosts-species . The geographic distribution of four species is important to the differentiate between the four *Echinococcus* species ; *E. vogeli* and *E. oligarthus* are restricted to central and south America (Krammerer and Schantz . 1993) . *E.multilocularis* distributed throughout the northern hemisphere extending from parts of central Europe into Asia and western Alaska , but recently occur in central and north America (Rausch , 1997) . *E.granulosus* is the most widely distribution throughout the world in particularly common sheep herding areas of developing countries . In Libya , *E. granulosus* is the only species known to occur and responsible for hydatid disease in both human and domestic animals .

2.3 Strains of *E . granulosus* :

The term strain refers in the case of *E. granulosus* to « variants which differ statistically from other groups of the species in gene frequencies and in more characters of the actual of potential of hydatid disease » (Thompson and Lymbery , 1990 ; Thompson and McManus , 2002) . For many years morphological and biological variability has been noted between populations of *E. granulosus* in different geographical regions and in different hosts . Described differences have included morphology , biochemistry , physiology , pathogenicity , development patterns and invectivity to human and domestic animals (Thompson and Lymbery , 1988) ..

The nature and diversity of variation within the genus *Echinococcus* have evolved rapidly in recent years through characterization of the

nuclear and mitochondrial genomes of representative isolates of the strains (Bowles *et al.*, 1992 ; Bowles and Mc Manus , 1993a) . At the present time , 10 genetically distinct population (genotypes) of *E.granulosus* from different geographical areas are known to exist (Lavikainen *et al* ., 2003) . The globally distributed G1 genotype of sheep is maintained in life cycles involving dogs and sheep . Its found in Australian mainland , Europe , USA , Newzealand , Africa , China , Middle East , South America and Russian Federation . The strain predominates in most domestic hosts in these countries (EcKert and Thompson , 1988 and Euzéby , 1991) . Tasmanian sheep strain G2 genotype distributed in Tasmania and Argentine , its slightly different from the common sheep strain in mitochondrial DNA sequences . Buffalo strain G3 genotype in India . Horse strain G4 genotype , is adapted to horses and dogs throughout the united kingdom , Middle East , South Africa and Newzealand (Smyth and Davis , 1974 and Bowles *et al.*, 1992) . Cattle strain G5 genotype occurs in cattle and dogs in Europe , South Africa , India , Srilanka , Russian Federation and South America . Camel strain G6 genotype , in Middle East , Africa , China and Argentina in cycles involving camels and dogs . This strain was identified in Kenya, occurring in camels (Bowles *et al.*, 1992 and Bowles and Mc Manus , 1993b) . Pig strain G7 genotype , adapted to pigs and dogs has been reported in Europe , Russian Federation and South America (Mc Manus and Bryant , 1995) . Cervid strain G8 genotype in North America and Europe , its cycles involving wolves and dogs . Lion strain G9 genotype in Africa (Thompson and Mc Manus , 2002) . Fennoscandian cervid strain G10 genotype , in Finland (Lavikainen *et al.*, 2003) .

2.4 Biochemical profile of hydatid cysts :

McManus (1981) made a biochemical studies on the larval and adult stages of *E. granulosus* , he found that biochemical composition of *E. granulosus* of sheep origin in Kenya and United kingdom are identical and the constituents of DNA and RNA in both types were found similar in all the larval forms of *E. granulosus* . Sultan Sheriff *et al.* (1989) measured the levels of lipids and proteins in hydatid cysts fluid collected from lung and liver hydatid cysts of sheep and humans .

Shaafie *et al.* (1999) made a study on the biochemical profiles of hydatid cyst fluid of *E. granulosus* of human and animal origin from Libya . They found that there is quantitative variations in the levels of sodium , potassium , calcium , cholesterol , glucose , urea , creatinine and gama glutamyl transpeptidase in the cystic fluids of human and animal origins and reported that the similarities in the biochemical profiles of different hydatid cyst fluids suggest the existence of sheep strains of *E. granulosus* in human and other domestic animal in Libya . On the other hand Thompson and Lymbery (1991) suggested that biochemical studies on hydatid cysts from different host origins can provide valuable information to determine the existence of *E. granulosus* in Libya .

2.5 Epidemiology of hydatidosis :

The epidemiology of hydatid disease determined by the study of public health problem , risk factors , animal hosts and transmission cycles. Hippocrates described the human *E. granulosus* disease more than two thousand years ago with the peculiar term " liver filled with water " . Al-Rahzes the famous Arabian physician , subsequently wrote on hydatid cyst of the liver about a thousand years ago (Adams , 1849) . Hydatid disease still remains a serious health problem in certain parts of

the world and is endemic in Middle East , Mediterranean , South America and Australia (Erman *et al.*, 2001) .

Hydatid disease (*E. granulosus*) is endemic in many parts of the world . The annual incidence rates of human cystic echinococcosis in Northern Europe , Central Europe , Western Europe vary from sporadic , partially or mainly imported cases to low incidence rates of < 1 case per 100,000 inhabitants to higher rates up to > 10 cases per 100,000 (Navarrate *et al.*, 1991 ; Löscher *et al.*, 1992 ; Magnussen and Thorsen , 1992 and Braddick and Reily , 1993) . Cystic echinococcosis has long been recognized as a serious public health problem in Greece (Karpathios *et al.*, 1985) , in Turkey (Altinatas and Ozensoy , 1993) .

Echinococcus granulosus occurs at high rates of infection in most countries of the Middle East (Matossian *et al.*, 1977) . In endemic areas , the estimated range is 150 – 200 cases per 100,000 inhabitants (Gabriele *et al.*, 1997) . Important domestic intermediate hosts in the Middle East include the camels and sheep , with cattle , goats and donkeys also harbouring hydatid infections (Al-Abbassy *et al.*, 1980 ; Al-Yaman *et al.*, 1985 ; Abdel-Hafez *et al.*, 1986a ; Abdul-Salam and Farah , 1988 and Kamhawi and Hijjawi , 1992) . The large stray dog populations found in Middle Eastern countries are an important reservoir hosts of the infection.

Information on the public health problems in Middle Eastern countries is largely based on reported clinical case series . In Jordan , the annual diagnostic incidence was estimated to vary from 15 to 65 cases per 100,000 in different regions of the country (Kamhawi and Hijjawi , 1992). In Saudi Arabia , numerous clinical reports suggest that a considerable public health problem may exist (Laajan and Nouh , 1991

and Schaefer and Khan , 1991) . In Iraq , hydatidosis is a disease of major public health importance , where over 500 human cases of the disease were reported annually (Matossian *et al.*, 1977) . In Iran , the average national surgical incidence of cystic hydatid disease varies between 0.1 (%) and 4.5(%) per 100,000 in different provinces (Mahdi and Benyan , 1990) . An annual incidence is 3.6 (%) per 100,000 has been reported in Kuwaiti (Shweiki *et al.*, 1990) but only 30% of the patients were Kuwaiti. In Syria , 157 patients , accounting for 2 % of all admissions at the University Hospital ,were seen over a 7 years period (Munzer , 1991).

Hydatidosis has been reported to be more common among Christians than Muslims in Lebanon (Schwabe and Abou Daoud , 1961), and the disease was unknown in Somali Muslims in Kenya (Macpherson *et al.*, 1989) . These differences have often been assumed to be the result of differences in degrees of contact with dogs . Islamic religious believers consider the dog is an unclean animal and dogs are rarely allowed inside Muslim houses and human have little direct contact with dogs . These cultural differences may limit exposure of Muslim populations to dog-transmitted pathogen in comparison to their non-Muslim neighbours , they certainly have not excluded exposure to infection (Schantz *et al.*, 1995) .

Camels in east African region are an important intermediate host . However , *E. granulosus* occurring in this host as a distinct strain and rarely of ever infect humans (Schantz *et al.*, 1995) . Sheep and goats are the main intermediate hosts for sheep strain *E.granulosus* in Maasailand in Kenya (Macpherson , 1985) and probably in Ethiopia (Wosene , 1991). Goats and camels are thought to be the main host in Turkana , Kenya (Macpherson , 1981) .

Most pastoral peoples keep large numbers of dogs where infection with *E. granulosus* have be reported in 3 – 87 % of dogs in Sudan (Saad and Magzoub , 1986) , 39 – 70 % of dogs in Turkana , Kenya (Macpherson *et al.*, 1989) and 23 % in stray dogs in Somalia (Macchioni *et al.*, 1985) .

In North Africa *E. granulosus* is propagated primary by a domestic cycle involving the domestic dog as the definitive host and many species of livestock including camels , cattle , sheep , goats , pigs , horses , donkeys and buffaloes as intermediate hosts (El-Kordy , 1946 ; Dar and Taguri , 1978 ; Larbaoui *et al.*, 1980 ; Jaiem , 1984 ; Gusbi *et al.*, 1987 ; Pandey *et al.*, 1988 and Ahmed , 1991) . The local importance of each intermediate host species in maintaining the life cycle varies in different region , but this factor is often difficult to determine because many different domestic species infected . In all countries where the camel has been reported as an intermediate host , it is considered to be an important host for the local life cycle of the parasite .

The infection of dogs with *E . granulosus* have been reported from different countries , 20 % in Algeria (Senevet , 1951) , 20 – 51 % in Morocco (Sirol and Lefevre , 1971 ; Pandey *et al.*, 1987 , 1988) , 22 – 43 % in Tunisia (Jaiem , 1984 ; Bchir *et al.*, 1991) , 8-38 % in Libya (Packer and Ali, 1986 ; Gusbi , 1987 and Awan *et al.*,1990) and 1 to 10 % in Egypt (Abo-Shady , 1980 and Hegazi *et al.*, 1986). There are no dog control programmes in North Africa and the majority of dogs population have little contact with human (Gusbi , 1987 ; Shambesh *et al.*, 1992) .

In Tunisia between 800 and 1,200 new human cases of hydatidosis were reported every year for an annual incidence of 16.5 (%) per 100,000 (Gharbi *et al.*, 1985 and Achour *et al.*, 1989 and Anon , 1993) . Hydatidosis is highly prevalent in Morocco , the annual incidence is 6.5 (%) – 7.8 (%) per 100,000 have been reported (Pandey *et al.*, 1988 ; Ouhelli and Dakkak , 1992 and Kachani *et al.*, 1998) . Whilst in Algeria , 5,305 cases of hydatid disease were treated over a ten years period , giving an annual incidence of between 3.4 (%) to 4.6 (%) per 100,000 inhabitants (Larbaoui and Allyulya , 1979) .

Human hydatidosis have been reported in Egypt by many authors (Babars *et al.*, 1987 ; Romia *et al.*, 1992 ; Mazyad *et al.*, 1998 and Abu-Eisha , 1999) . Haridy *et al.* (1998) among camels imported from Sudan for human consumption over five years reported 5.5 % (1992) , 6.1 % (1993) , 6.7 % (1994) , 8.4 % (1995) and 4.3 % (1996) of camels were infected with hydatid disease .

2.6 Hydatidosis in Libya :

2.6.1 Human hydatidosis :

The prevalence of human hydatidosis depends on the degree of exposure of human to the source of infection , the strain of *E. granulosus* and individual resistance to infection . On the other hand both male and female of different age groups are equally susceptible to the infection with hydatid disease .

The first Libyan case of human hydatidosis in Benghazi was reported by Castigliola (1918) . In 1927 Onorato detected 11 human cases during radiological survey in Tripoli .Fossati (1970) estimated an incidence of 0.35 % in Benghazi (147 cases out of a population of 42000

people) by using radiology these cases were confirmed by surgery . Between 1971 and 1976 , about 0.70 – 0.85 % of the surgical cases , out of all admission , in Benghazi hospitals were infected with hydatid cysts (Dar and Taguri , 1978 and Kalani *et al* , 1984) .

Dar and Taguri (1979) estimated that more than 20 % of hydatid infection was discovered accidentally . They mention that children and young adults under the age of 20 years constitute 20 – 25 % of all infected cases . El-Boulaqi and Taguri (1980) reported that of the 180 surgically confirmed hydatid cases recorded , 97 (53.9 %) were females and 83 (46.1 %) males from all over Eastern Libya . The most infected organ was liver (53.3 %), followed by lungs (30.6 %), Abdomen (7.8 %) and kidneys , the most susceptible age was below 24 years. Papadopoulos (1981) recorded age and sex distributions of 104 cases of the hydatid disease (operated surgically in chest hospital of Tripoli during the years 1972 – 1979) . Rahman (1982) reported that 14 women had been found to be infected with pelvic hydatid disease in Benghazi during 1971 – 1979 .

Gebreel *et al* (1983) indicated that a good number of *Echinococcus* infections were found among 200 inhabitants in El-Abiar with prevalence rate of 8 % in the urban area and 12 % in the surrounding rural area by using enzyme-linked immunosorbent (ELISA) . Aboudaya (1985a) reported that 111 persons had been infected with hydatid disease among the 22979 patients admitted for surgery in Tripoli central Hospital a period of 1972 – 1979 with an overall incidence of 0.48 % of patients were females and 38 % males . The sites of infection were 88 liver infection (77.6 % of cases) followed by the muscle (4.4 %) abdomen (2.7 %) and lungs (1.7 %) .

In 1992 Shambesh *et al* , carried out ultrasound study in five area of northwestern region of Libya put the prevalence at 2 % . Saad and Fatehell-Bab (1996) reported that 10 cases of hydatid disease were recorded in the Sebha University Hospital . The incidence of the hydatid disease within Libyan population is said to be 1 / 100 000 individual (Shambesh , 1997) .

In 1999 , the result of a large-scale nationwide survey of cystic echinococcosis , based on ultrasound examinations , revealed that those are living in the northern coastal area had the disease (Shambesh *et al* , 1999) . Khan and El-Buni (1999) collected the finger-prick blood samples on filter paper discs for the presence of anti-hydatid antibodies from University students in Benghazi where the study revealed that sero-positive rate was 1.66 % . Al-Saqur *et al* (2001) reported that 1.03 % of humans were infected with hydatidosis in Southern Libya mainly in Sebha. Tashani *et al* (2002) recorded that 306 surgically confirmed human cases of cystic echinococcosis were identified in the medical records studied in Benghazi and reported that the post-operative reports for 215 of the patients which indicated that most hydatid cysts were found in liver (65 %) , followed by the lungs (13 %) , spleen (5 %) , bones (2 %) and kidneys (2 %) .

Mohamed *et al.* (2004) reported that the prevalence in humans from Sebha Hospital during the years 2002 and 2003 was 1.103 % from the total cases of admitted in the Surgery Department , they mention that , this not necessarily reflect an actural incidence rate in Sebha .

The serological techniques were used in some studies to determine the prevalence of human hydatidosis (Gebreel *et al.*, 1983 ; Khan *et al.*,

1990 ; Shambesh *et al.*, 1992 ; 1999 and Khan and Kidwai , 1996) . These studies indicate the infection rates but do not clarify the relationship between the presence of antibodies and clinical signs and current presence of hydatid cysts .

2.6.2 Livestock hydatidosis :

The earliest known reports on infection rates in intermediate hosts are those of Medulla (1931) and Cicogna (1961) reported a prevalence rate of 40 % in sheep and 70 % in cattle in slaughterhouse in Tripoli were infected with hydatid disease . Gebreel *et al.* (1983) reported the incidence (%) of the disease in herbivorous animals in slaughterhouse of Benghazi during the years 1975 – 1977 .

Aboudaya (1985b) collected statistics on hydatid cysts in domestic animals from 46 slaughterhouses distributed throughout Libya . The rate of infection in Libyan reared animals was highest in camels (27 %) and lowest in sheep (4.3 %) , with a low to moderate infection rate of 6.6 % in cattle . The study carried out by Gusbi *et al* (1987) on the incidence and geographical distribution of hydatid cysts in sheep from ten localities in Libya revealed that 12.74% of adult sheep and 0.29 % of lambs were found infected with hydatid cysts . The most infected organ was liver (97.26 %) followed by lungs (58.70 %) , kidneys (1.79 %) , spleen (0.74%) and heart mesentery and muscles (0.24 % each) . They suggested that the high cyst prevalence rate and high fertility in sheep indicates that the sheep / dog « strain » of *E . granulosus* is the most widespread strain in Libya .

Gusbi *et al.* (1990) in Kufra reported that 50 % of hydatid cysts infection in camels which reflects the preciousness of these animals to

their owners and their reluctance to slaughter them at an early age . Prevalence rates in goats and cattle were 1.5 % and 4.5 % respectively . The total fertility of goat cysts was 61.7 % and most of these cysts occurred in lungs . All cattle cysts were completely sterile (Gusbi *et al* , 1990) . In 1997 Ibrahem and Gusbi described camels as maintenance hosts in all north country with sheep , goats and cattle playing a secondary role in the Life cycle of *E . granulosus* .

The study conducted by Ibrahem and Craig (1998) on slaughtered animals in different areas of northern Libya , they found that the prevalence rates of hydatidosis in sheep , goats and camels were 15.8 % , 3.8 % and 48 % . About the site of infection , the liver was predominant infected site with prevalence rates of 86 % in sheep , 100 % in goats , while in camels , lung was the most infected organ (85.4 %) and liver (33%) , they indicated that more than 90 % of the camel hydatid cysts were fertile .

Gdourra (2003) made a study on 1380 local camels slaughtered at the abattoirs in Sirt city . The prevalence of hydatid cysts was 3.62 % . The results showed that the infection was not age dependent and differences in prevalence between male and female camels were statistically insignificant .

Mohamed *et al.* (2004) conducted a study on 1022 camels , 200 sheep , 85 cattle and 50 goats slaughtered at the abattoirs in Sebha city . Those animals were inspected for hydatid cysts of *E . granulosus* , the prevalence of hydatidosis was 12.62 % in camels , 18.5 % in sheep and 4% in goats, and there were no differences in prevalence between male

and female camels . However , older camels had more infection than younger one .

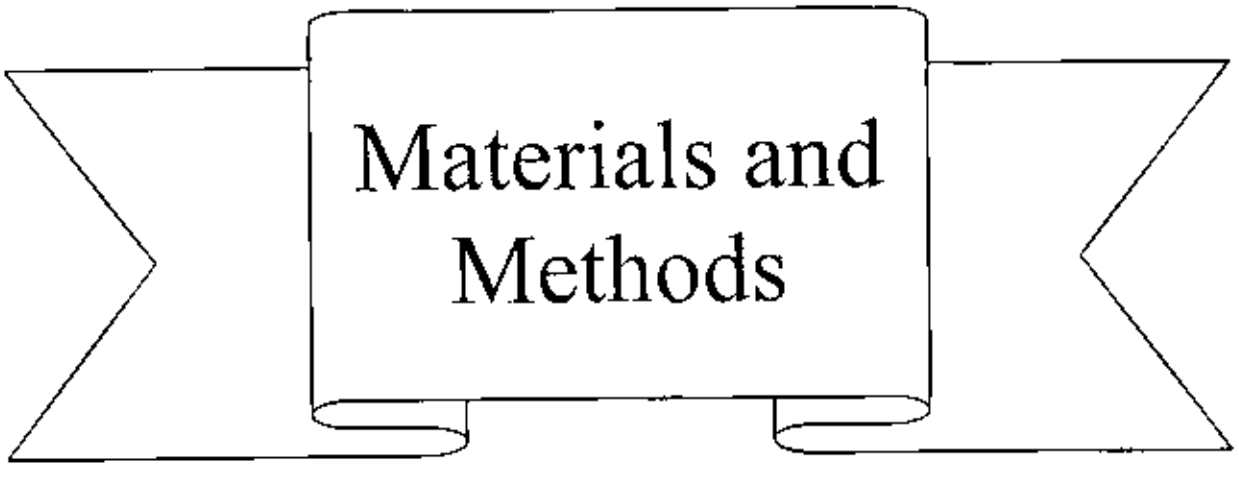
2.6.3 Definitive host Hydatidosis :

The dog population in Libya can be divided into three groups : (1) stray dogs are found in all urban and rural areas , (2) farm dogs are those kept by farmers to guard the animals or farm property , (3) shepherd dogs and (4) pet or house dogs . The scarcity of data of adult worm *E . granulosus* in dogs may due to the fear of infection discourages the examination of dogs for the determination of prevalence of the adult parasite .The first study on the prevalence of the disease in dogs was recorded by Cicogna in 1961 , were found that 60 % in the shepherd dogs and 10% in the town dogs were infected with *E . granulosus* . Packer and Ali (1986) conducted a survey on dogs in Tripoli , they found that the prevalence rate of 11.8 % of stray dogs and 5.9 % of farmer dogs, while no *E . granulosus* infection was recorded from pet dogs .

In 1987 Gusbi , carried out a survey in 14 localities in Libya , the overall prevalence rate reported was 27.81 % , the infection rates reported for stray , sheep , domestic and semi domestic dogs were 40.3 % , 34.8%, 7.7 % and 9.3 % respectively . The study indicated that the incidence rates in dogs in southwestern region of Libya are quite low , 6.7 % in Sebha , 0 % in Gdames , Socna and Ghat , while the prevalence of the worms was generally higher in the whole coastal areas . The same study revealed that 80 % of dogs were infected in Tobruk , which is markedly high rate .Awan *et al* , 1990 , conducted a survey on the prevalence of *Echinococcus* infection in dogs from five Libyan cities , and found that 36.8 % and 35.3 % of stray and semi domesticated dogs were infected , and the load of infection varied between 1 to 12821 worms per dog

El-Sageyer (1989) reported that the incidence rates in dogs in Benghazi and Tripoli were 7.14 % and 26.19 % respectively .

Generally , in Libya , the majority of the dog population have little contact with human (Gusbi , 1987 , Shambesh *et al* , 1992) . The dogs are kept to guard sheep and goats from predatory stray dogs and wolves and usually more than one dog is found per household (Shambesh *et al*,1992).


Materials and
Methods

3. MATERIAL AND METHODS

3.1. Study area :

Sirt is located on the Mediterranean coastal some 450 km east of Capital Tripoli (Fig. 2) . It occupies an area of 69 km² most of it is semiarid area . with population of about 140.000 (Source : National information Board , Sirt 2001) . The warmest months of the year are July and August where temperature may rise to 42C° , while the coolest months are January and February where temperature may decline up to 7 C° . The relative humidity ranges from 67 to 71 % throughout the year . The average rainfall exceeds 253 mm . (Source : Sirt Meterological Office , Personal Communication 2001) .

3.2. Animals :

There are about 1 470 000 sheep and 950 000 goats in Sirt , the later are raised on state owned farm within the city . There are about 110 000 camels in the Sirt areas (Sirt agriculture and animals resource office , 2005) .

3.2.1. Studied animals :

The animals which slaughtered at Sirt abattoir used in this study including : sheep (*Ovis aries*) the famous Libyan Barbary breed type . There are characterized by their coarse wool , fat tail and straight or slightly convex nasal profile (Devendra and Mcleroy , 1982) (plate1a and 2) , goats (*Capra hircus*) (plate 2) and camels (*Camelus dromedaries*) both considered by abattoir veterinarians to be indigenous species and therefore of native Libyan breeds (plate 3) . Cattle (*Bos Taurus*) breeds studied were of three types , Friesian , Jersey and local (plate 4a and b) .

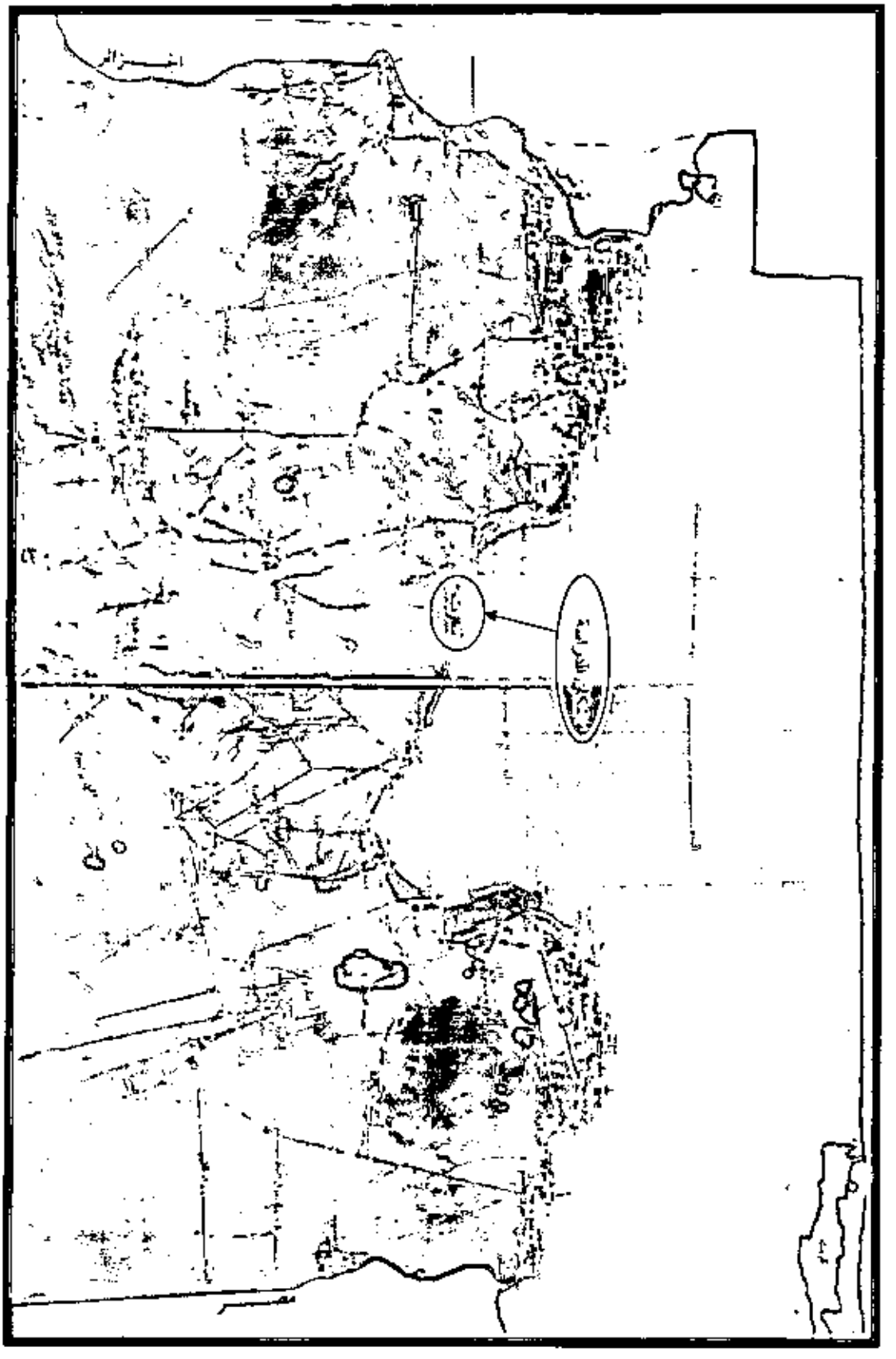
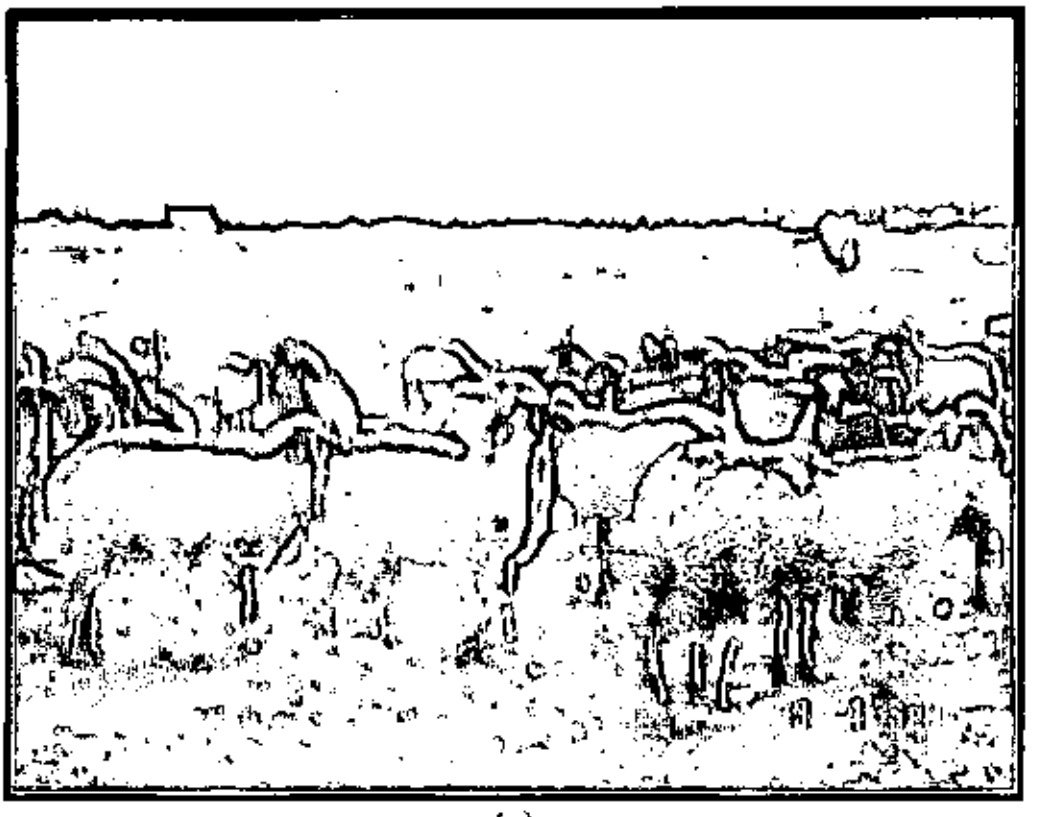
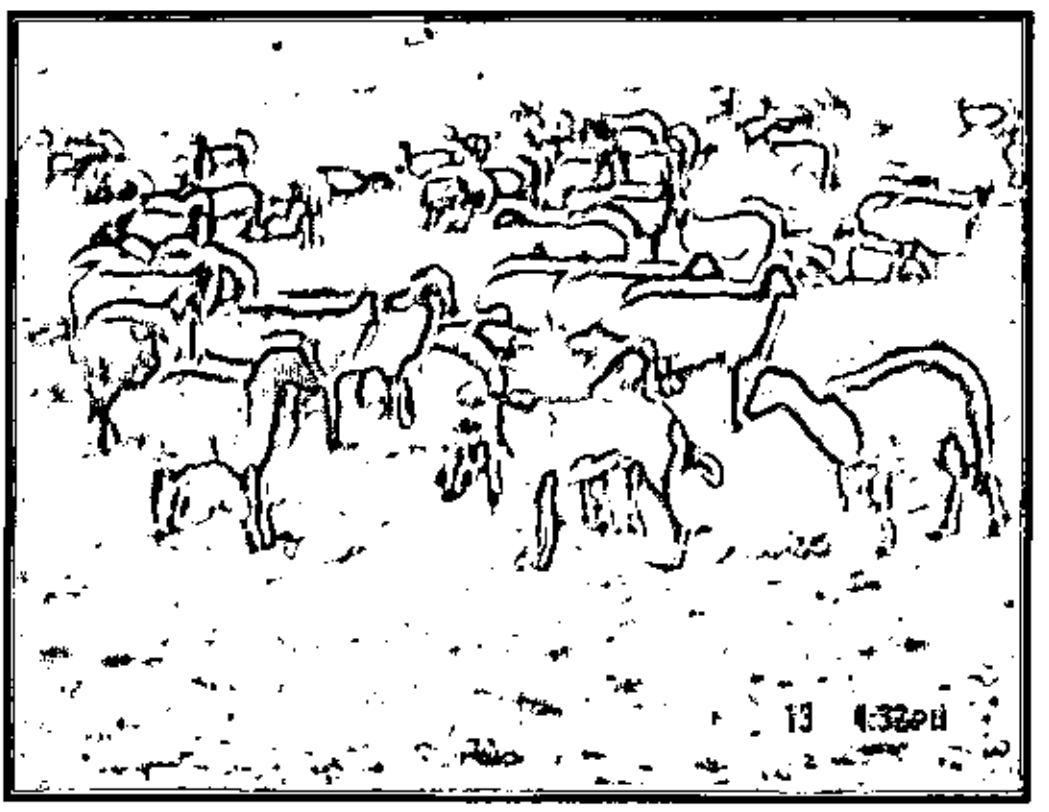


Figure 2 : Map of Libya-showing place of the study (Sirt city) .



(a)



(b)

Plate 1a , b : Libyan Bar bary sheep (*Ovis aries*) .

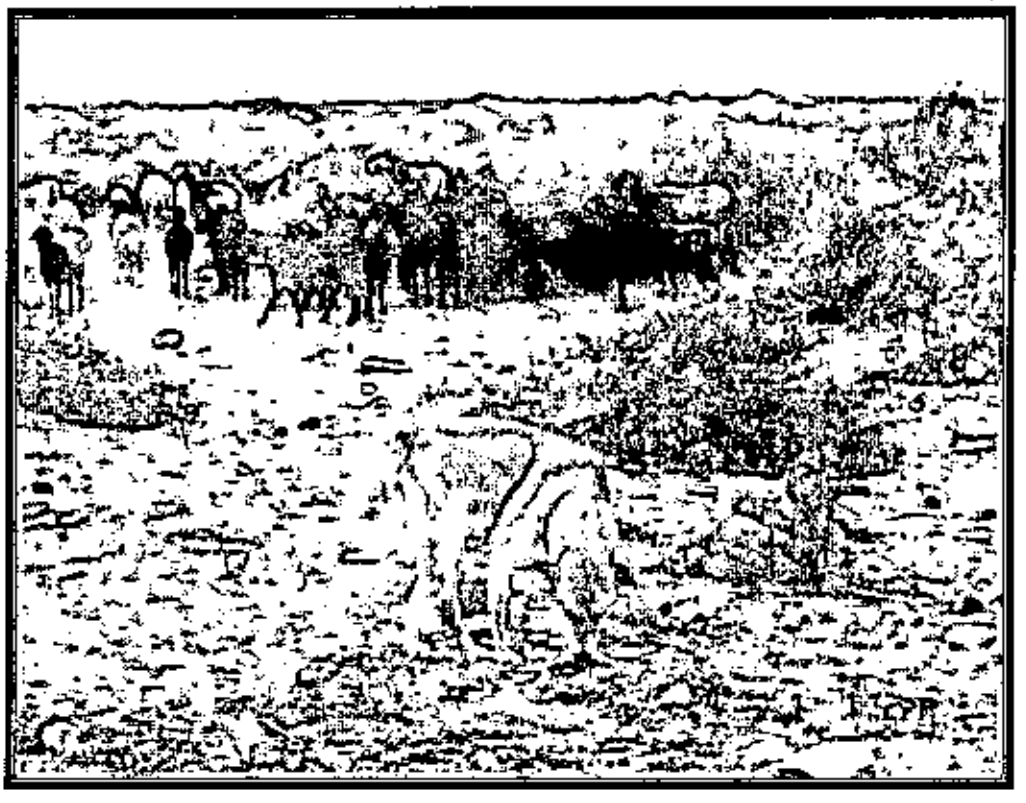


Plate 2 : Goats (*Capra hircus*) .

Plate 3 : Libyan camels (*Camelus dromedaries*) .

(a)

(b)

Plate 4a , b : Cattle (*Bos taurus*) bread Friesian (a) , local (b) .

The age of these animals were determined by conventional dentition method (Ensminger ,1983) .

3.3. The abattoirs :

Sirt city has central authorized abattoir . It is housed in new buildings in which the slaughtering and processing of carcasses are carried out manually (plate 5 and 6) . All animals included in the present study were slaughtered at the central abattoirs during the period from July 2004 to Jun 2005 . The abattoirs was visited twice a week .

3.4 Detection of parasite :

Over a year from July 2004 to Jun 2005 , a total of 12769 animals (3794 sheep , 8123 goats 739 camels and 113 cattle) were examined for hydatid cysts .The abattoir was visited early in the morning in order to attend the initial segregation of slaughtered animals , during each visit , sex , age and breed of each animal was recorded . Liver and lungs were fully and carefully examined for the presence of hydatid cysts (plate 7) , in addition heart , kidneys and spleen were examined in cases of heavy infections Criteria used for the identification of cysts were those described by Gracey and Collins (1992) .

3.5 Examination of hydatid cysts :

Liver and lungs were the organs usually examined for hydatid cysts , All detected cysts were incised and subjected to macroscopic examination Infected organs were carefully washed with water to remove debris and blood , then placed separately in labeled plastic bags and transported to the laboratory of Zoology Department Faculty of Science , Al-Tahadi University as soon as possible for examination . The total number of cysts

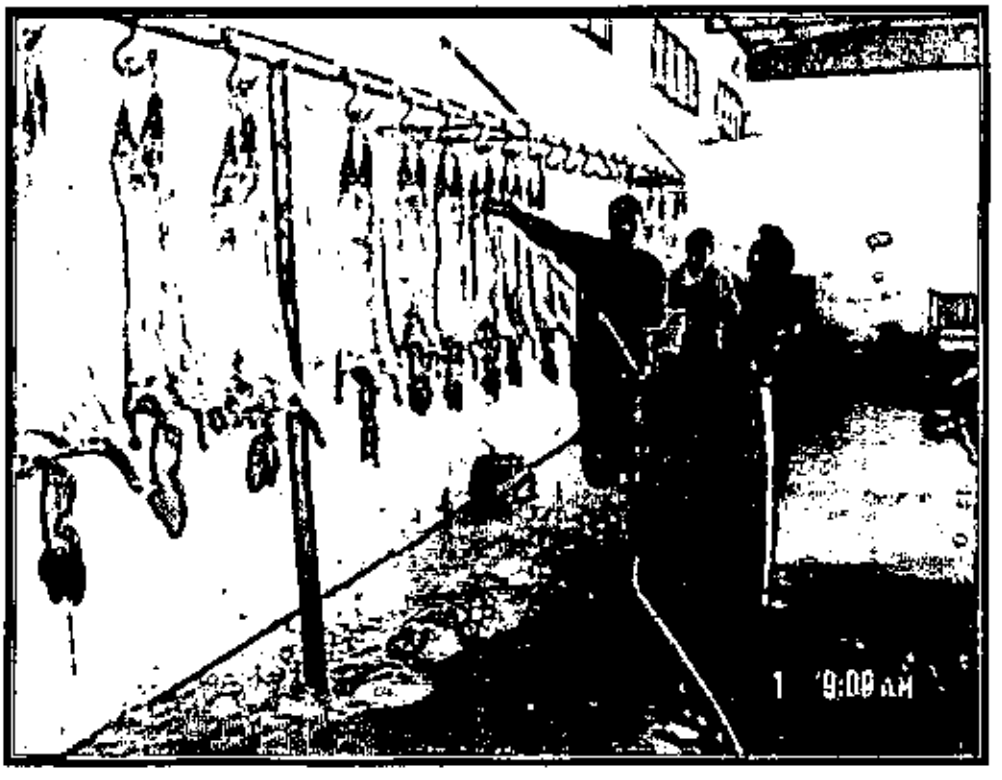


Plate 5 : Sheep hall of Sirt abattoir showing manual processing of carcasses .

Plate 6 : Slaughtered sheep investigated by abattoir veterinarian to find out any hydatid cysts .

Plate 7 : Inspection of sheep liver for hydatid cysts .

for each infected organ was recorded (plate 8) , and five cysts (if possible) from each organ were selected for further examination .

3.6 Determination of hydatid cyst characteristics :

3.6.1 Cyst size : The cyst size (length and width) was measured by ruler in centimeters and recorded :

Hydatid cyst fluid was aseptically aspirated using sterile syringes within few hours after collection of hydatid cysts , and the fluid was emptied into graduated cylinder and the hydatid fluid volume was determined . A part of hydatid fluid was emptied into glass petri dishes , the cysts were opened and carefully examined for the presence of daughter cysts , hydatid sand and germinal layer . The germinal layer was removed and taped onto the hydatid fluid to release broad capsules .

3.6.2 Estimation of hydatid cyst fertility :

A drop of hydatid cyst fluid was placed onto a glass slide , then examined by light microscope for the presence of broad capsules or protoscoleces . The cyst considered as fertile when its fluid contained protoscoleces , while those without protoscoleces considered as sterile cysts (plate 9) .

3.6.3 Estimation of hydatid cyst viability :

The viability of hydatid cyst was tested (1) using 0.1 % eosin stain test (Himonas *et al* , 1994) , this test show that those protoscoleces stained with eosin stain were considered as dead or non-viable protoscoleces , while the viable protoscoleces did not stained and appeared transparent (plate 10) . (2) published morphological descriptions of hydatid cyst protoscoleces (Saidi , 1976 and Thompson , 1995) . This

Plate 8 : Examination of livers and collection of hydatid cysts .

Plate 9 :Microscopic examination fof hydatid cysts and studding the morphology of protoscoleces and rostellum hooks in fertile cysts .

test depends on the colour , size , and their muscular contraction of protoscoleces . Cyst viability was calculated as the percentage of viable protoscoleces . This was by using aliquots of 100 µL of hydatid fluid containing hydatid sand , for each cyst examined spread on microscope slide , then examined under a light microscope (plate 11) .

3.6.4 Morphological studies on rostellar hooks :

Fertile cysts of liver and lungs of sheep , goats and camels were used in the study of morphological features of rostellar hooks (Table 1) . 25 cysts were randomly selected from each organ and 8 protoscoleces were measured for each cyst . 25 large and 25 small hooks used for examination were recorded and measured for each protoscolex . Viable protoscoleces were used and their viability was determined using the method described above . The arrangement of hooks and their total number in each protoscolex was recorded . The measurements of the total hook length , blade length , handle length and width for large and small hooks were done according to the method described by Sweatman and Williams (1963) (plate 12) . This was studied by using a calibrated Carl Ziess microscope at a magnification of x 100 (Oil immersion) . Protoscoleces and hooks were photographed using a Carl Ziess photomicroscope .

3.7 Statistical analysis :

A computerized statistical program SPSS . V11.5 (Statistical Package Science Sociality) has been used to analyze the data of the present study . Prevalence was calculated as the percentage of infected animals and the mean intensity as the mean number of cysts per infected animal . The significance levels were determined by using Pearson and Spearman rank

correlation . The accepted level of significance was $P < 0.05$ and stong significance was $P < 0.01$.

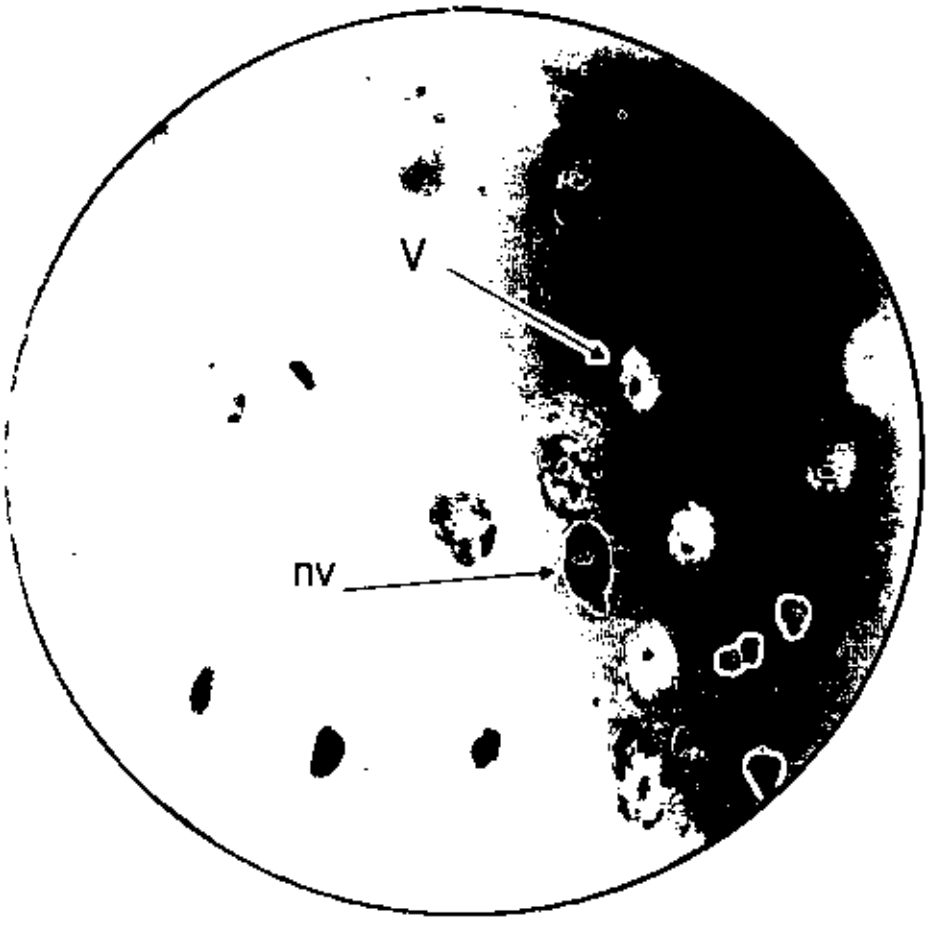


Plate 10 : Hydatid cysts showing viable (v) and non-viable (nv) protoscoleces following treatment with 0.1 % eosin to test viability (x = 10) .

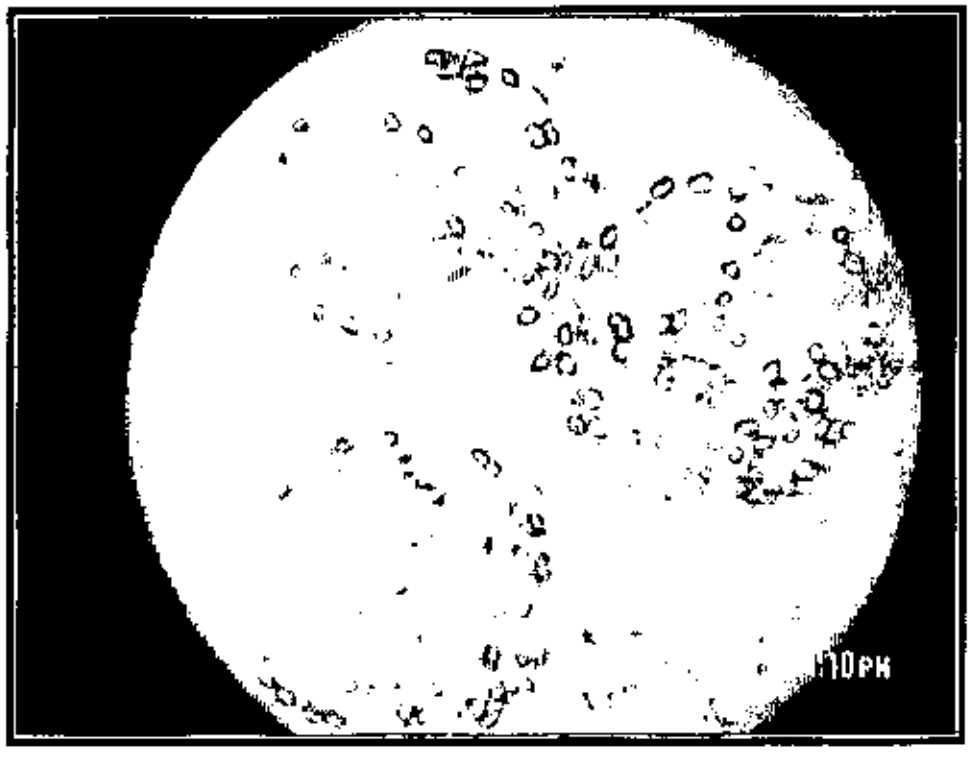


Plate 11 : Hydatid cyst from sheep liver , broad capsule showing viable and non-viable protoscoleces (X = 40) .

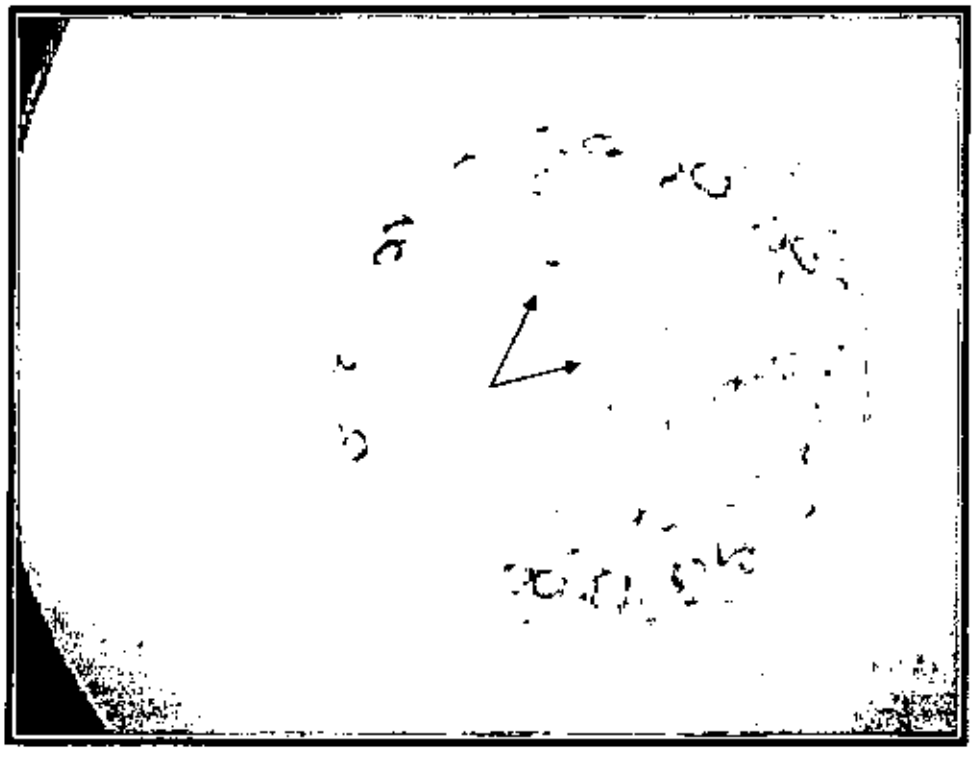
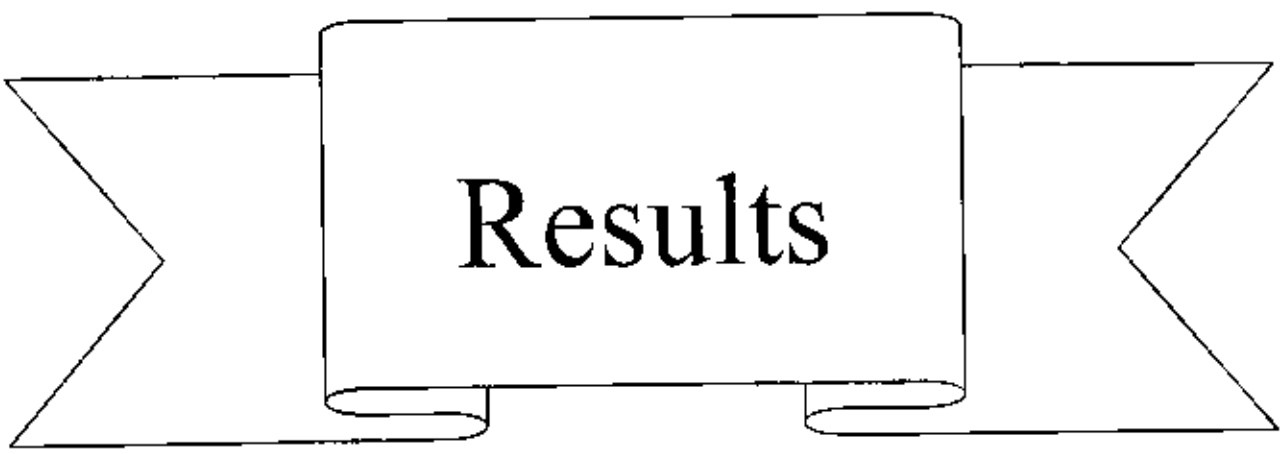


Plate 12 : Protoscoleces from sheep liver hydatid cysts showing the arrangement of rostelum hooks (X = 100) .

Table 1 : Number of rostellum hooks from liver and lung hydatid cysts of *Echinococcus granulosus* examined per host species .

Animal species (N)	Sheep			Goats			Camels			Cattle		
Organ	Liver	Lungs	Total	Liver	Lungs	Total	Liver	Lungs	Total	Liver	Lungs	Total
No. of organs	10	10	20	13	17	20	14	16	20	18	12	30
No. of cysts	25	25	50	25	25	50	25	25	50	25	25	50
No. of protoscoleces	100	100	200	100	100	200	100	100	200	0	0	0
Total no. of hooks	100	100	200	100	100	200	100	100	200	0	0	0


Results

4. RESULTS

Hydatidosis has been reported from different communities where dogs , the main definitive host , have been access to raw offal through home-slaughter from poorly regulated abattoirs or from scavenging carcasses or discarded offal (plates 13 , 14 , 15 and 16) .

The annual slaughter rate in Sirt was determined by the total number of animals slaughtered at Sirt abattoir . During the period from July 2004 to June 2005 , 13136 sheep , 30099 goats , 239 cattle and 3233 camels were slaughtered at Sirt abattoir .

4.1. Prevalence :

The hydatid cysts of *Echinococcus granulosus* were detected in all animal species examined . A total of 186 (4.9 %) of 3794 sheep , 195 (2.4%) of 8123 goats , 17 (15 %) of 113 cattle and 20 (2.7 %) of 739 camels were found to be infected with hydatid cysts (Table 2 and Fig. 3) .

4.1.1 Prevalence according to sex :

The prevalence of hydatidosis in both males and females of intermediate hosts (sheep , goats , cattle and camels) shown in Table (3) and Fig. (4) . The results have shown that prevalence in males sheep was 5.9 % (73/1247) and females was 4.4 % (113/2547) . No significant differences in prevalence of hydatidosis between both sexes (P = 0.58) . Prevalence of hydatidosis in female goats 3.9 % (90/2287) was higher than that detected in males 1.8 % (105/5836) . The results show significant differences in prevalence between males and females of goats (P = 0.000). While the prevalence in males and females cattle was 12.9% (9/70) and 18.6 % (8/43) respectively , the results show no significant

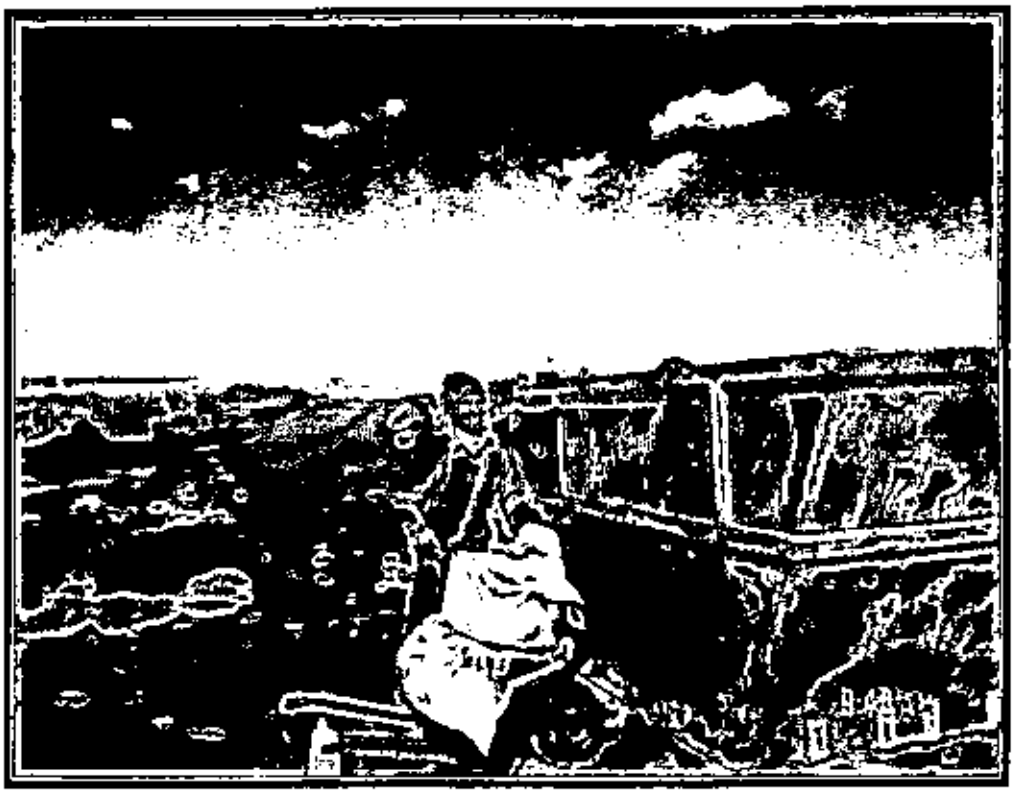


Plate 13 : The method by which the proper disposal of condemned organs .

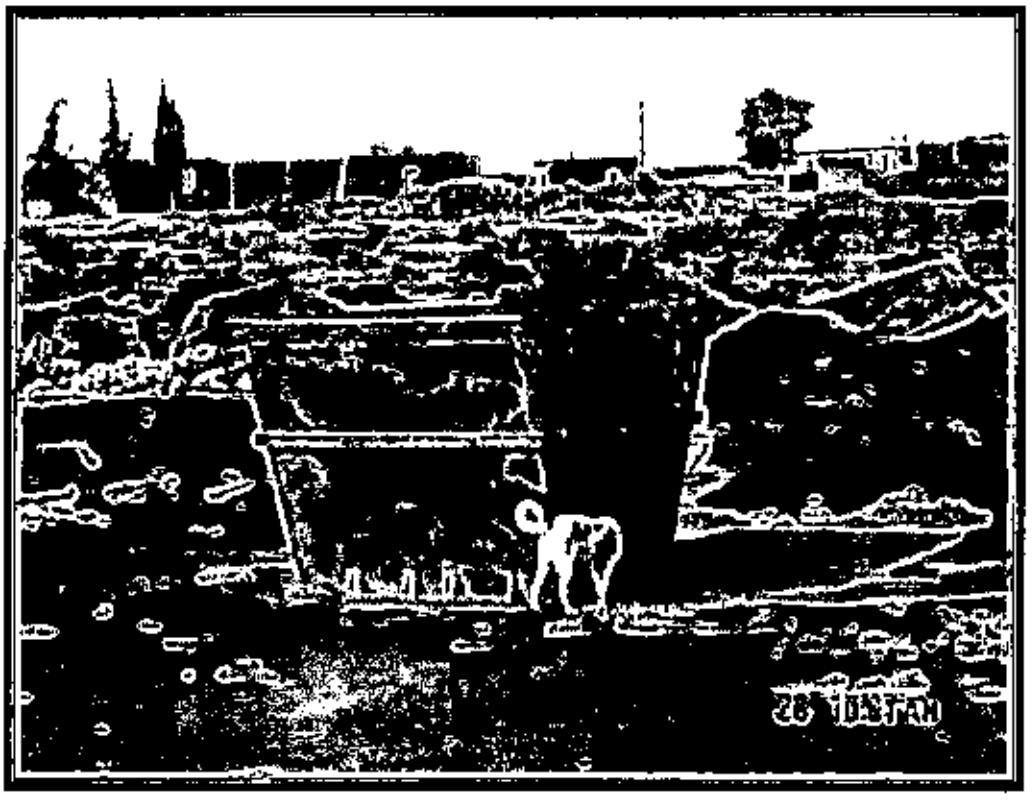


Plate 14 : Dogs (The main definitive host) near the place where the disposal of condemned organs .

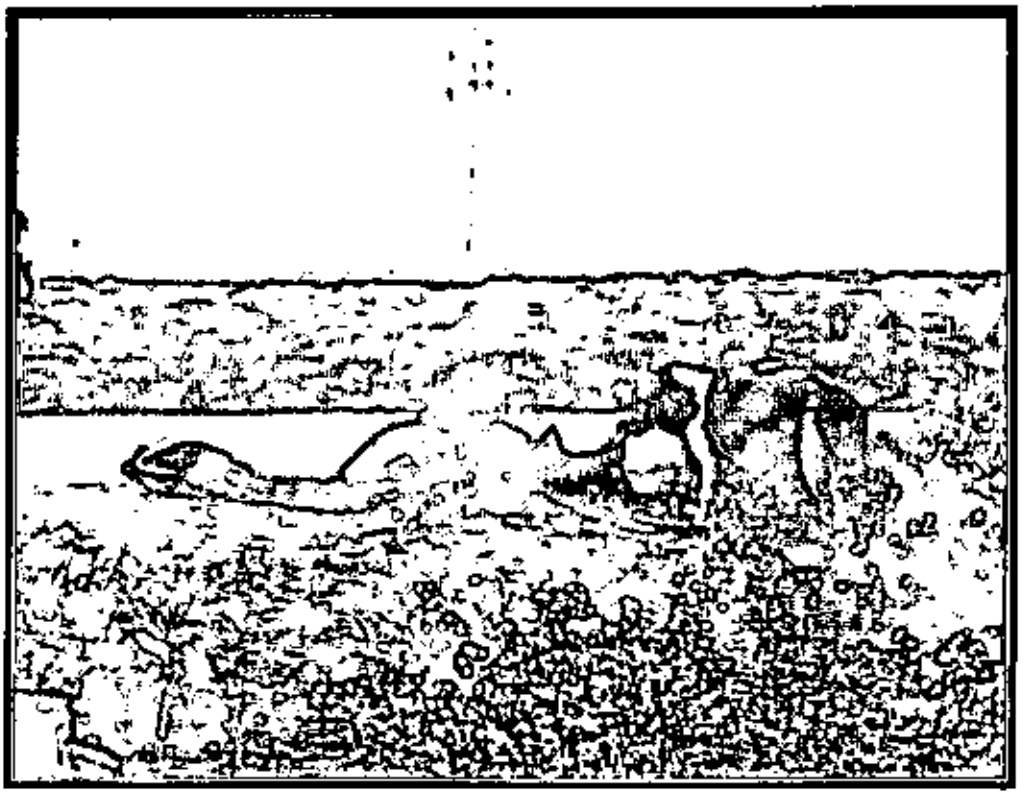


Plate 15 : Showing the dog-definitive host feeding on dead camel .

Plate 16 : Sirt dump-Note the dogs feeding on disposal of condemned organs .

Table 2 : Overall prevalence of hydatid cysts in slaughtered animals hosts in Sirt .

Examined animals	No. examined	No. of infected (%)
Sheep	3794	186 (4.9)
Goats	8123	195 (2.4)
Cattle	113	17 (15.0)
Camels	739	20 (2.7)

Figure 3 : Overall prevalence of hydatid cysts in slaughtered sheep, goats , cattle and camels in Sirt .

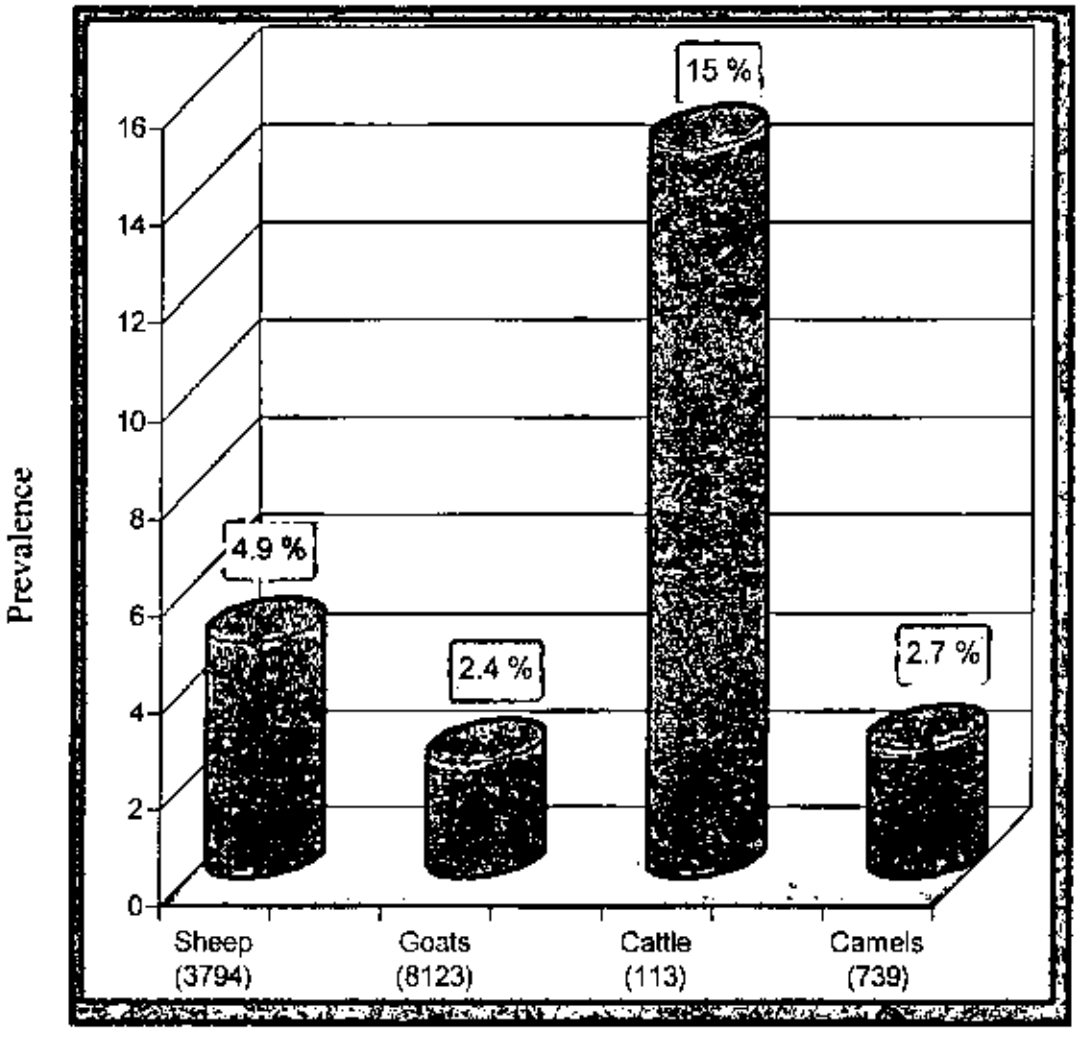


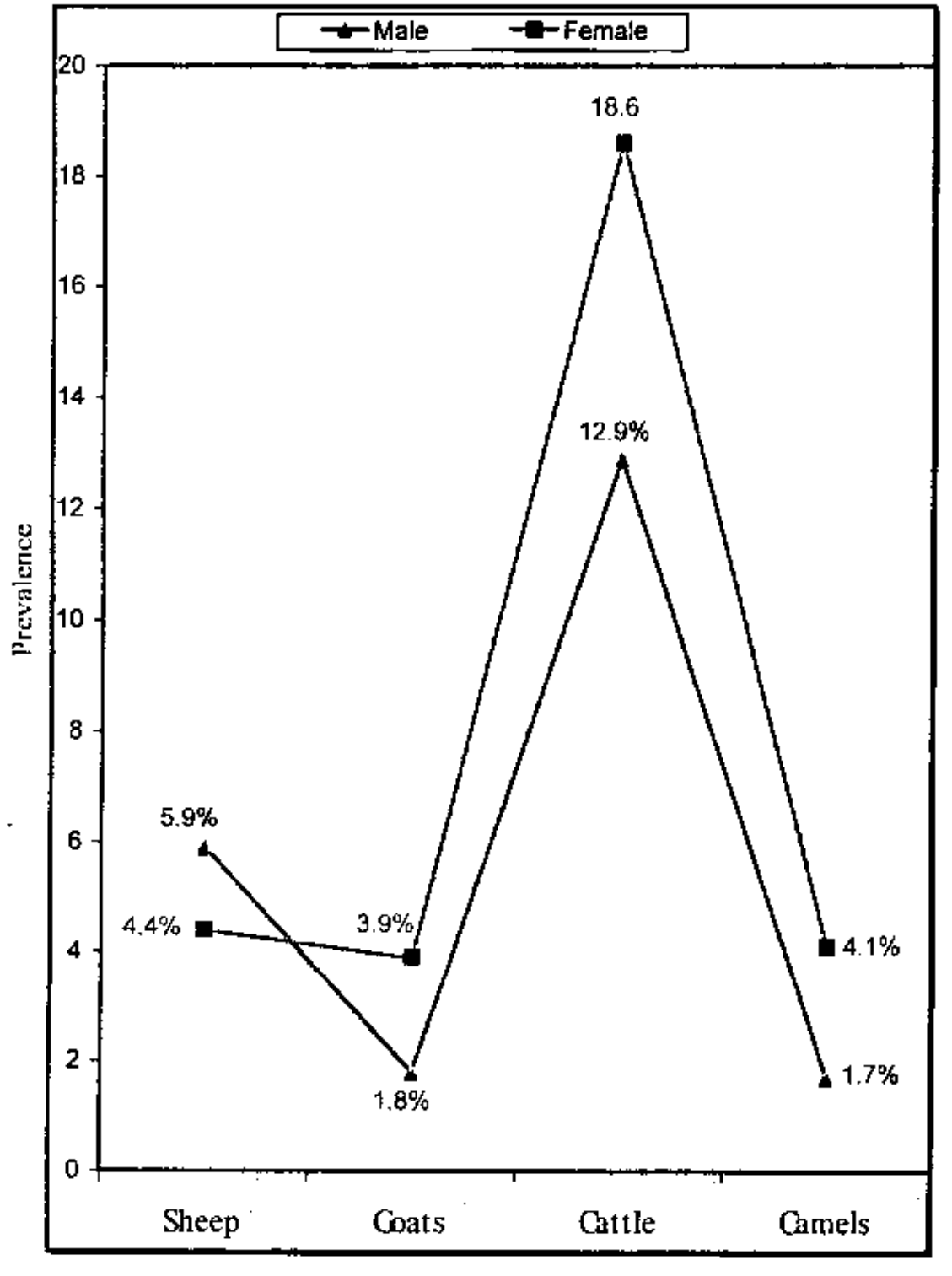
Table 3 : The prevalence of hydatid cysts in slaughtered animals according to their sex .

Sex	Sheep		Goats		Cattle		Camels	
	No. examined	No. infected (%)	No. examined	No. infected (%)	No. examined	No. Infected (%)	No. examined	No. infected (%)
Male	1247	73 (5.9)	5836	105 (1.8)	70	9 (12.9)	421	7 (1.7)
Female	2547	113 (4.4)	2287	90 (3.9)	43	8 (18.6)	318	13 (4.1)
Total	3794	186 (4.9)	8123	195 (2.4)	113	17 (15.0)	739	20 (2.7)
p-value	0.058		0.000		0.411 (Non-sig)		0.044	

*** Correlation is significant at the 0.01 level (2 – tailed) .

* Correlation is significant at the 0.05 level (2 – tailed) .

Figure 4 : Prevalence of hydatid cysts in slaughtered animals according to their sex .



differences between both sexes (P = 0.411) . The prevalence of hydatid cysts in males of camels was 1.7 % (7/421) while in females was 4.1 % (13 / 318) . There was a slight correlation and significant difference (P= 0.044) in the prevalence of hydatidosis between both sexes .

4.1.2 Prevalence according to age :

The relationship between prevalence of hydatidosis and different age groups shown in (Table 4) .The results have shown that infection is age dependent in sheep . the older animals had higher the prevalence .The infection rates were 3.0 % , 4.6 % , 7.1% and 12.6 % detected in age groups < 1 , 1- < 2 , 2 - < 3 and ≥ 3 years respectively (Fig. 5) . The results have shown strong correlation and significance between age groups of sheep (P = 0.000) . The same trend was seen in goats with the older group (goats older than three years) having a prevalence of 10 % which contrasts with less than 1.5% in goats younger than 1 year (Fig. 6). The results shows a strong correlation and significant difference between age groups of goats (P = 0.000) .

Prevalence of infection in cattle older than 3 years was 22.7 % This was significantly higher than 2.1 % seen in cattle younger than 1 year and the 14.3 % in the age groups ranging between 1 – 2 years (Fig. 7) . Among camels , infection with age was similar to that of the other animals species . The infection rates were 0.8 % , 2.5 % , 7.3 % and 9.2 % detected among age groups < 1 , 1- < 2 , 2 - < 3 and ≥3 years (Fig. 8) The differences between age groups were statistically significant (P = 0.000) .

4.1.3 Prevalence according to season :

Infection of hydatid cysts among all animal species were recorded throughout the year and the results showed that there is no correlation and a significance difference between the four seasons (winter , spring , summer and Autumn) . The infection rates during the Winter , Spring , Summer and Autumn were 4.6 % , 4.8 % , 4.9 % and 5.4 % respectively among sheep , 3.2 % , 2.7 % , 1.8 % and 2.6 % respectively among goats, 15.4 % , 13.0 % , 12.5 % and 17 .8 % respectively among cattle and 2.5%, 2.7% , 2.9% and 2.7% respectively among camels (Table 5 and Figs. 9, 10 , 11 , 12) .

Table 4 : The prevalence of hydatid cysts in slaughtered animals according to their age .

Age (Years)	Sheep		Goats		Cattle		Camels	
	No. examined	No. infected (%)	No. examined	No. infected (%)	No. examined	No. infected (%)	No. examined	No. Infected (%)
< 1	1920	58 (3.0)	4062	61 (1.5)	47	1 (2.1)	393	3 (0.8)
1 – < 2	947	44 (4.6)	2422	40 (1.7)	21	3 (14.3)	199	5 (2.5)
2 – <3	592	42 (7.1)	1141	44 (3.9)	23	8 (34.8)	82	6 (7.3)
≥ 3	3	42 (12.5)	498	50 (10.0)	22	5 (22.7)	65	6 (9.2)
Total	3794	186 (4.9)	8123	195 (2.4)	113	17 (15.0)	739	20 (2.7)
p-value	0.000***		0.000 ***		0.001 **		0.000 ***	

Correlation is significant at the 0.01 level (2-tailed) .

Table 5 : The prevalence of hydatid cysts in slaughtered animals according to their seasons .

seasons	Sheep		Goats		Cattle		Camels	
	No. examined	No. infected (%)	No. examined	No. infected (%)	No. examined	No. infected (%)	No. examined	No. Infected (%)
Winter	610	28 (4.6)	1189	38 (3.2)	13	2 (15.4)	163	4 (2.5)
Spring	1093	52 (4.8)	2112	56 (2.7)	23	3 (13.0)	146	4 (2.7)
Summer	1276	62 (4.9)	2845	50 (1.8)	32	4 (12.5)	207	6 (2.9)
Autumn	815	44 (5.4)	1977	51 (2.6)	45	8 (17.8)	223	6 (2.7)
Total	3794	186 (4.9)	8123	195 (2.4)	113	17 (15.0)	739	20 (2.7)
p-value	0.476		0.160		0.686		0.895	

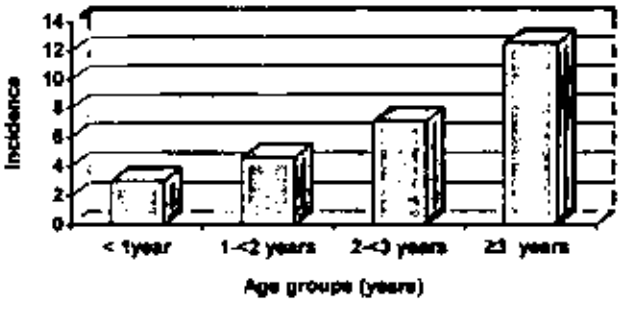


Figure 5 : Prevalence of hydatidosis in sheep at different age groups

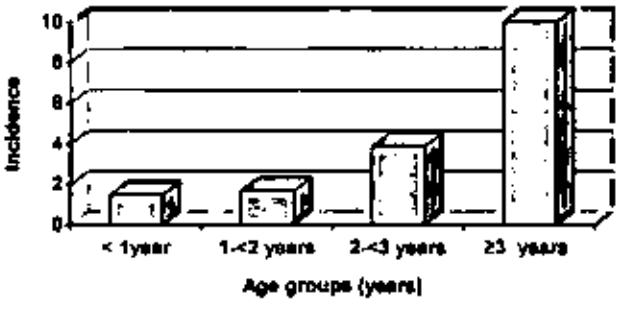


Figure 6 : Prevalence of hydatidosis in goats at different age groups

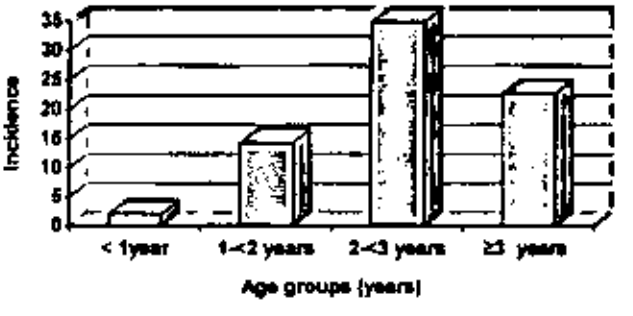


Figure 7 : Prevalence of hydatidosis in cattle at different age groups

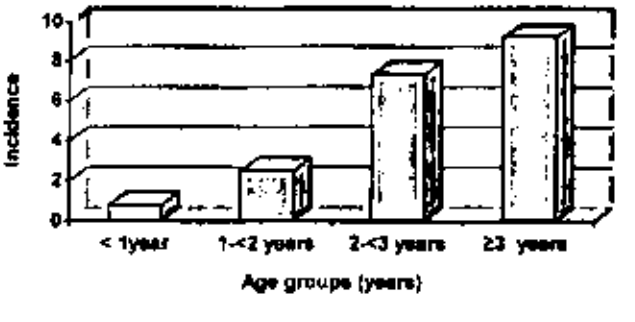


Figure 8: Prevalence of hydatidosis in camels at different age groups

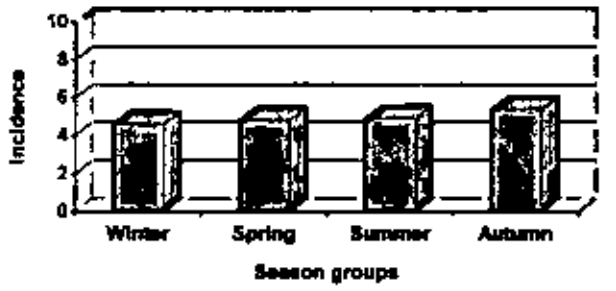


Figure 9 : Prevalence of hydatidosis in sheep at different seasons

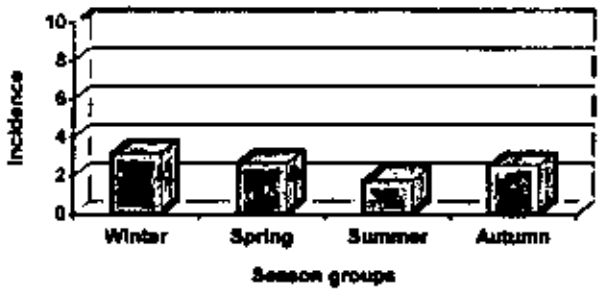


Figure 10 : Prevalence of hydatidosis in goats at different seasons

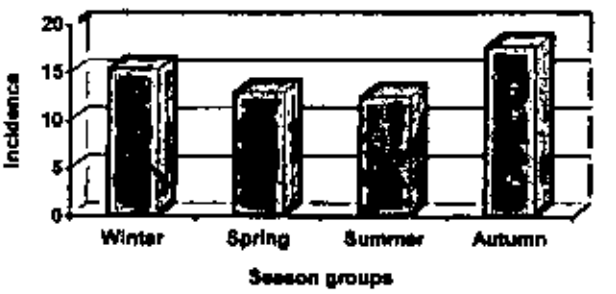


Figure 11 : Prevalence of hydatidosis in cattle at different seasons

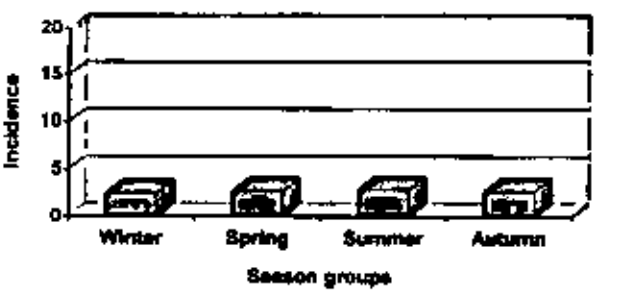


Figure 12 : Prevalence of hydatidosis in camels at different seasons

4.2 Location of hydatid cysts :

The most commonly infected organs in all examined animal species were the liver and the lungs . Extra-hepatic and extra-pulmonary cyst locations (e.g. spleen , kidney , body cavity) constituted less than 0.5 % of all infections and have therefore excluded from the analysis . The prevalence of the hydatidosis in liver and lungs of sheep were 77.9 % and 48.9 % respectively .

Liver infection in goats was encountered in 73.2 % of all cases , but lungs were also infected with 60 % . Cattle cysts were seen in the liver in 64.7 % of infected cases , whereas lung infection constituted 58 % of these infections . Lungs were the most infected organs in camels 75 % of infected cases and liver infection was 50 % of these cases .

On the other hand the results shown that infected liver , lungs and both liver and lungs in sheep were encountered in 51.1 % , 22.6 % and 26.3 % respectively . The infection in liver was higher than lungs and liver and lungs together . In goats liver infection was 39 % , lung infection was 27.7 % and infection in liver and lungs together was 33.3%. The results showed that liver infection in cattle was encountered in 41.2 % and lungs infection in 35.3 % , liver and lungs together constituted 23.5 % . Infection in camels showed that lungs infection 50 % was higher than liver infection 25 % and liver and lungs together 25 % (Table 6 and Fig. 13) .

The results showed strong correlation and there is a significant differences between age groups of sheep and goats and location of cysts (P = 0.000) . The age had no effect on cyst location (Table 7) . The sex of animals had no effect on cyst location of cysts in organs in sheep ,

Table 6 : Location of hydatid cysts in liver and lungs of sheep , goats, cattle and camels .

% of infected organs out of total infected animals				
Examined animals	**No. infected**	**Infected liver (%)**	**Infected lungs (%)**	**Infected liver&lungs (%)**
Sheep	186	95 (51.1)	42 (22.6)	49 (26.3)
Goats	195	76 (39.0)	54 (27.7)	65 (33.3)
Cattle	17	7 (41.2)	6 (35.3)	4 (23.5)
Camels	20	5 (25.0)	10 (50.0)	5 (25.0)

Figure 13 : Location of hydatid cysts in liver and lungs of sheep , goats, cattle and camels .

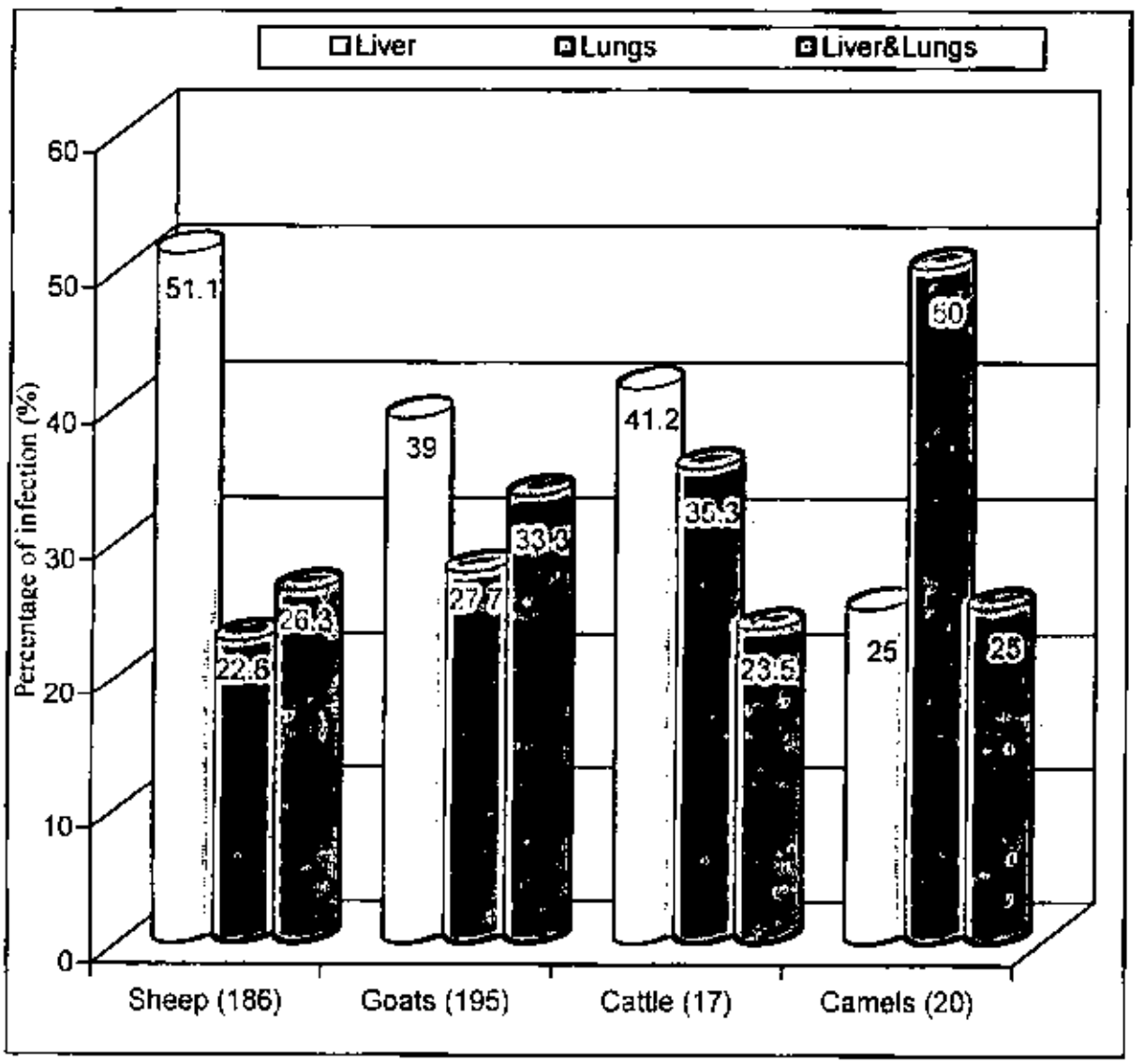


Table 7 : Location of hydatid cysts in the liver and lungs of the sheep , goats , cattle and camels according to their age .

Age (Years)	Sheep			Goats			Cattle			Camels		
	Infected liver	Infected lungs	Infected liver& lungs	Infected liver	Infected lungs	Infected liver& lungs	Infected liver	Infected lungs	Infected liver& lungs	Infected liver	Infected lungs	Infected liver& lungs
< 1	40	12	6	32	24	5	0	1	0	0	3	0
1 – 2	25	14	5	19	16	5	2	1	0	0	1	0
2 – 3	19	10	13	13	10	21	5	1	2	2	3	2
> 3	11	6	25	12	4	34	0	3	2	2	3	3
p-value	0.000***			0.000 ***			0.160 (Non-sig)			1.00 (Non-sig)		

Table 8 : Location of hydatid cysts in the liver and lungs of the sheep , goats , cattle and camels according to their sex.

Sex	Sheep			Goats			Cattle			Camels		
	Infected liver (%)	Infected Lungs (%)	Infected liver& lungs (%)	Infected liver (%)	Infected lungs (%)	Infected liver& lungs (%)	Infected liver (%)	Infected Lungs (%)	Infected liver& lungs (%)	Infected liver (%)	Infected lungs (%)	Infected liver& lungs (%)
Males	36 (49.3)	16 (21.9)	21 (28.8)	49 (46.6)	28 (26.7)	28 (26.7)	4 (44.4)	4 (44.4)	1 (11.1)	2 (28.6)	4 (57.1)	1 (14.3)
Females	59 (52.2)	26 (23.0)	28 (24.8)	27 (30.0)	26 (28.9)	37 (41.1)	3 (37.5)	2 (25.0)	3 (37.5)	3 (23.1)	6 (46.2)	4 (30.7)
Total	95	42	49	78	54	65	7	6	4	5	10	5
p-value	0.589 (Non-sig)			0.011 *			0.414 (Non-sig)			0.533 (Non-sig)		

cattle and camels . While there is a significant difference between sex of goats and cyst location (P = 0.01) (Table 8) .

4.3 Intensity of infection :

The number of cysts in sheep varied from 1 to 20 cysts in both liver and lungs . 53.8 % (1-3 cysts) , 36.0 % (4-8 cysts) and 10.2 % (9-20 cysts) . Goats showed 61.6 % (1-3 cysts) , 28.7 % (4-8 cysts) and 9.7 % (9-20 cysts) . Cattle showed 52.9 % (1-3 cysts) , 35.3 % (4-8 cysts) and 11.8 % (9-20 cysts) . Camels showed 40 % (1-3 cysts) , 35 % (4-8 cysts) and 25 % (9-20 cysts) . (Table 9 and Fig. 14) .

4.3.1 Intensity of infection and age :

The results showed that a significant difference between age groups and intensity of infection in sheep and goats (P=0.00) . The intensity of infection in organs of sheep and goats increase with age increase . On the other hand there was no correlation and a significant difference between age and intensity of infection in cattle (P = 0.699) and camels (P = 0.053) (Table 10) .

4.3.2 Intensity of infection and sex :

The results showed that there is no correlation between the intensity of infection and sex of sheep , goats , cattle and camels (Table 11) .

Table 9 : Intensity of infection in liver and lungs of sheep , goats , cattle and camels .

Examined animals	Intensity of infection		
	1 – 3 cysts (%)	4 – 8 cysts (%)	9 – 20 cysts (%)
Sheep (186)	100 (58.8)	67 (36.0)	19 (10.2)
Goats (195)	120 (61.6)	56 (28.7)	19 (9.7)
Cattle (17)	9 (52.9)	6 (35.3)	2 (11.8)
Camels (20)	8 (40.0)	7 (35.0)	5 (25.0)

Figure 14 : Intensity of infection in liver and lungs of sheep , goats , cattle and camels .

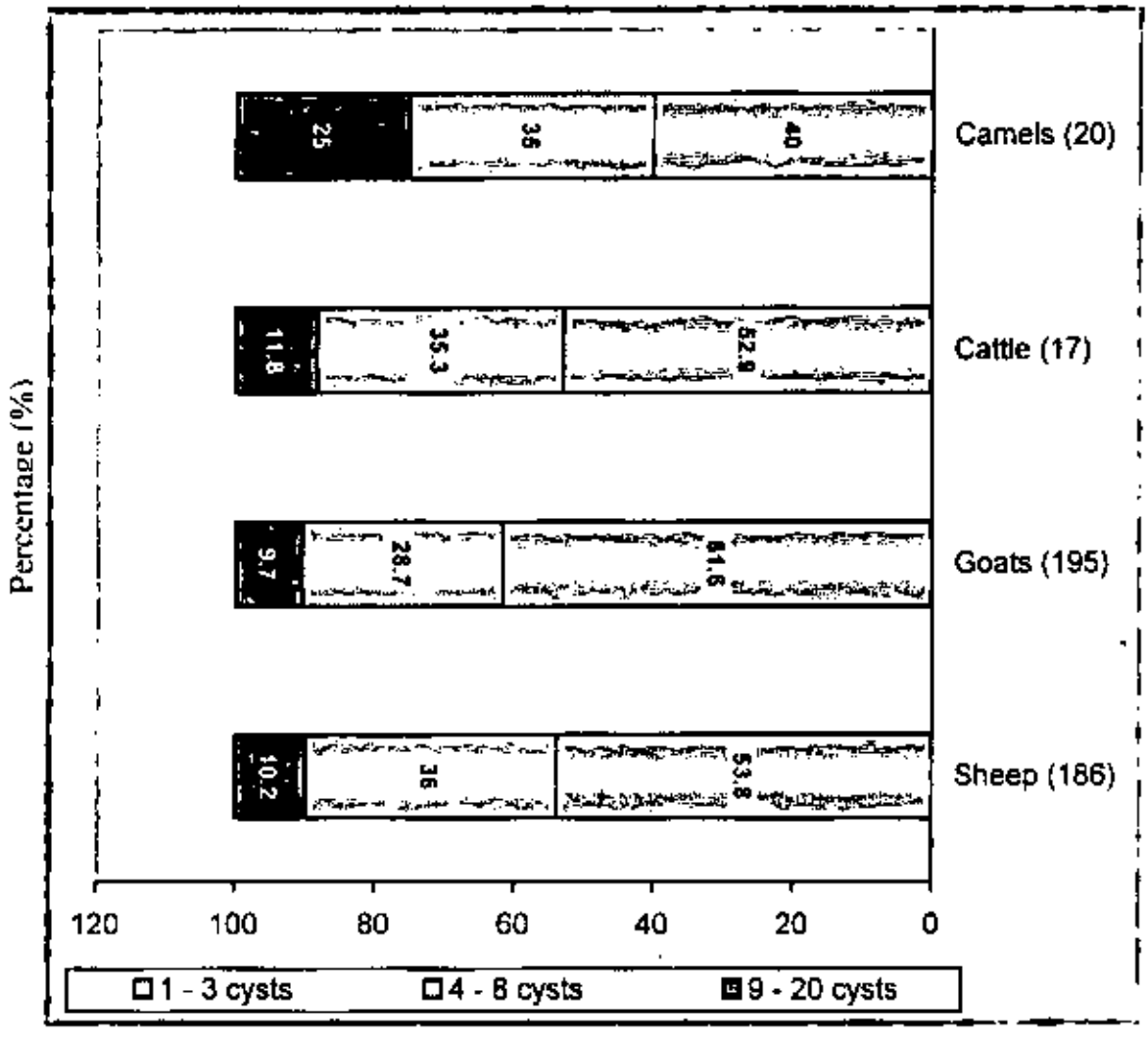


Table 10 : Intensity of infection in sheep , goats , cattle and camels according to their age .

Examined animals	Age (Years)	Intensity 1 – 3 cysts (%)	4 – 8 cysts (%)	9 – 20 cysts (%)	p-value
Sheep 186	<1	43 (74.1)	13 (22.4)	2 (3.5)	0.000***
	1-<2	26 (59.1)	18 (40.9)	0 (0.0)	
	2-<3	18 (42.9)	18 (42.9)	6 (14.2)	
	≥ 3	13 (31.0)	18 (42.9)	11(26.1)	
Goats 195	<1	54 (88.5)	7 (11.5)	0 (0.0)	0.000***
	1-<2	22 (55.0)	13 (32.5)	5 (12.5)	
	2-<3	23 (52.2)	16 (36.4)	5 (11.4)	
	≥ 3	21 (42.0)	20 (40.0)	9 (18.0)	
Cattle 17	<1	1 (100.0)	0 (0.0)	0 (0.0)	0.699
	1-<2	1 (33.3)	1 (33.3)	1 (33.4)	
	2-<3	6 (75.0)	1 (12.5)	1 (12.5)	
	≥ 3	1 (20.0)	4 (80.0)	0 (0.0%)	
Camels 20	<1	3 (100.0)	0 (0.0)	0 (0.0)	0.053
	1-<2	0 (0.0)	1 (100.0)	0 (0.0)	
	2-<3	4 (44.4)	4 (44.4)	1 (11.2)	
	≥ 3	1 (14.3)	2 (28.6)	4 (57.1)	

Table 11 : Intensity of infection in sheep , goats , cattle and camels according to their sex .

Intensity					
Examined animals	Sex	1 – 3 cysts (%)	4 – 8 cysts (%)	9 – 20 cysts (%)	p-value
Sheep 186	Males 73	39 (53.4)	27 (37.0)	7 (9.6)	0.963
	Females 113	61 (54.0)	40 (35.4)	12(10.6)	
	Total 186	100(53.8)	67 (36.0)	19(10.2)	
Goats 195	Males 105	66 (62.9)	31 (29.5)	8 (7.6)	0.439
	Females 90	54 (60.0)	25 (27.8)	11(12.2)	
	Total 195	120(61.5)	56 (28.7)	19 (9.7)	
Cattle 17	Males 9	4 (44.5)	3 (33.3)	2 (22.2)	0.257
	Females 8	5 (62.5)	3 (37.5)	0 (0.0)	
	Total 17	9 (52.9)	6 (35.3)	2 (11.8)	
Camels 20	Males 7	2 (28.6)	3 (42.8)	2 (28.6)	0.559
	Females 13	6 (46.2)	4 (30.7)	3 (23.1)	
	Total 20	8 (40.0)	7 (35.0)	5 (25.0)	

4.4 Hydatid cyst characteristics :

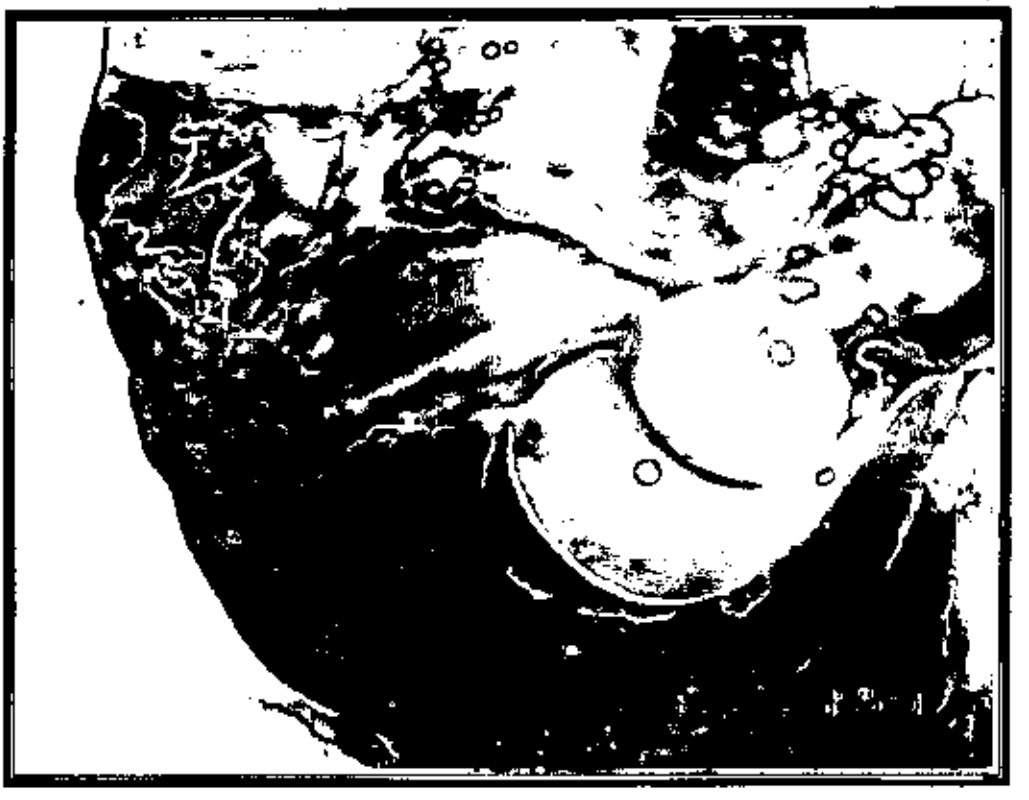
4.4.1 Cyst morphology :

Hydatid cysts in all animals examined were either superficial (plate 17a and b) or deeply (plate 18a and b) within the infected organs . Hydatid cysts in the liver were relatively easier to recognize visually than those in the lungs .The cyst walls were thick or thin and semi-transparent in nature .

The shape of cysts seen was spherical , elliptical and / or irregular , whereas cysts of lungs were mostly spherical in shape . Cysts in sheep , cattle and camels were large cysts (5 – 10 cm) with inter-communicating chambers . The results showed that different shapes of hydatid cysts were seen , these cysts may be broadly grouped into two categories , ellipsoids and irregular shapes (plates 19 and 20) .

4.4.2 Cyst dimensions :

cyst dimensions for the four animal species examined are shown in Table 12 . The size of hydatid cysts examined were various . The average of dimensions were between hairpin and 20 cm . The cysts were classified according to their size to four groups : small (less than 2 cm) , medium (2-5 cm) , large (5 – 10 cm) and very large (10 – 20 cm) . In sheep most of hydatid cysts found in liver (56.7 %) were medium size (2 – 5 cm) , whereas, those found in lungs (45 %) were small in size (<2 cm) (Table 13) . In goats , 45.8 % of hydatid cysts in liver were medium size and 42.8 % in lungs were small size . Large hydatid cysts were found only in liver and lunges of goats as 4.2 % and 15.4 % respectively . Among all four species , the largest cysts were found in liver and lungs of goats . In cattle and camels , the most hydatid cysts were found in liver and lungs were small size (Table 14) .



(a)

(b)

Plate 17a , b : Hydatid cysts of *Echinococcus granulosus* in camel liver .

(a)

(b)

Plate 18 a , b : Hydatid cysts of *Echinococcus granulosus* in cattle liver .

Plate 19 : Sheep liver infected with hydatid cysts .

Plate 20 : Goat lungs infected with hydatid cysts .

Table 12 : The size of hydatid cysts in liver and lungs of sheep , goats , cattle and camels .

Examined animals	Examined organs	No. of cysts measured	Cyst size			
			<2cm (%)	2-5cm (%)	6-10cm (%)	11-20cm (%)
Sheep	Liver	30	10(33.3)	17(56.7)	3 (10.0)	0 (0.0)
	Lungs	20	9 (45.0)	8 (40.0)	3 (15.0)	0 (0.0)
Goats	Liver	24	9 (37.5)	11(45.8)	3 (12.3)	1 (4.2)
	Lungs	26	11(42.3)	10(38.5)	1 (3.8)	4 (15.4)
Cattle	Liver	30	20(66.7)	4 (13.3)	6 (20.0)	0 (0.0)
	Lungs	20	10(50.0)	5 (25.0)	5 (25.0)	0 (0.0)
Camels	Liver	29	18(62.1)	6 (20.7)	5 (17.2)	0 (0.0)
	Lungs	21	13(61.9)	5 (23.8)	3 (14.3)	0 (0.0)

Table 13 : The size of hydatid cysts of sheep , goats , cattle and camels according to their sex .

Examined animals	Sex	Cyst size					
		No. of cysts measured	<2cm (%)	2-5cm (%)	6-10cm (%)	11-20cm (%)	p-value
Sheep	Males 25	25	6(24.0)	16(64.0)	3(12.0)	0 (0.0)	0.138
	Females 25	25	13(52.0)	9(36.0)	3(12.0)	0 (0.0)	
Goats	Males 22	22	6(27.3)	9(40.9)	4(18.2)	3 (13.6)	0.043*
	Females 28	28	14(50.0)	12(42.9)	0 (0.0)	2 (7.1)	
Cattle	Males 32	32	17(53.1)	7(21.9)	8(25.0)	0 (0.0)	0.266
	Females 18	18	13(72.2)	2(11.1)	3(16.7)	0 (0.0)	
Camels	Males 21	21	12(57.1)	8(38.1)	1(4.8)	0 (0.0)	0.619
	Females 29	29	19(65.5)	3(10.3)	7(24.2)	0 (0.0)	

Table 14 : The size of hydatid cysts of sheep , goats , cattle and camels according to their age .

Examined animals	Age (Years)	No. of cysts measured	Cyst size				p-value
			<2cm (%)	2-5cm (%)	6-10cm (%)	11-20cm (%)	
Sheep	<1	10	5(50.0)	3(30.0)	2(20.0)	0 (0.0)	0.908
	1-<2	10	3(30.0)	5(50.0)	2(20.0)	0 (0.0)	
	2-<3	13	7(53.8)	5(38.5)	1 (7.7)	0 (0.0)	
	≥3	17	4(23.5)	12(70.6)	1 (5.9)	0 (0.0)	
	Total	50	19(38.0)	25(50.0)	6(12.0)	0 (0.0)	
Goats	<1	12	6(50.0)	6(50.0)	0 (0.0)	0 (0.0)	0.068
	1-<2	9	3(33.3)	6(66.7)	0 (0.0)	0 (0.0)	
	2-<3	14	5(35.7)	4(28.6)	4(21.4)	2(14.3)	
	≥3	15	6(40.0)	5(33.3)	1 (6.7)	3(20.0)	
	Total	50	20(40.0)	21(42.0)	5(10.0)	5(10.0)	
Cattle	<1	10	9(90.0)	1(10.0)	0 (0.0)	0 (0.0)	0.023*
	1-<2	12	7(58.3)	5(41.7)	0 (0.0)	0 (0.0)	
	2-<3	19	9(47.4)	1 (5.3)	9(47.4)	0 (0.0)	
	≥3	9	5(55.6)	2(22.2)	2(22.2	0 (0.0)	
	Total	50	30(60.0)	9(18.0)	11(22.0)	0 (0.0)	
Camels	<1	6	6(100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0.248
	1-<2	12	7(58.3)	2(16.7)	3(25.0)	0 (0.0)	
	2-<3	16	8(50.0)	7(43.8)	1 (6.2)	0 (0.0)	
	≥3	16	10(62.5)	2(12.5)	4(25.0)	0 (0.0)	
	Total	50	31(62.0)	11(22.0)	8 (16.0)	0 (0.0)	

4.4.3 Fertility of hydatid cysts :

The physical content of hydatid cysts may be fluid , caseous , or calcified . Sheep had significantly higher percentage of fertile cysts (72%) than other animals . Cattle had the higher percentage of sterile cysts among the four inspected species (70 %) . Calcified cysts accounted for 14 % in cattle and in sheep and camels 4 % each , while goats had 8 % . On the other hand , caseous cysts were more frequently observed in cattle (16 %) than that in other three species (8 % for each) (Table 15 and Fig. 15) .

The age groups had no effect on the cyst fertility in any animal ($P < 0.05$) . There is no evidence indicate that age groups had species. effect on the fertility of hydatid cysts (Table 16) . Among all animal species , the results shown that sex had no effect on cyst fertility ($P > 0.05$) (Table 17). The relationship between fertility and organ type is shown in Table (18) . Liver of sheep and camels had more fertile cysts than the lungs but there was no statistical difference between cysts of the two organs ($P > 0.05$) .

4.4.4 Viability of hydatid cyst protoscoleces :

The viability of hydatid cysts was determined through the relationship between the ratio of viable protoscoleces to total number of the protoscoleces in each cyst . The viability of hydatid cyst protoscoleces was classified according to their percentage into three categories : low viability (5 – 40 %) , medium viability (41 – 60 %) and high viability (61 – 100 %) .The results showed that high viability (38 %) , medium viability (20 %) and low viability (12 %) of protoscoleces in sheep , whereas in goats 26 % high , 16 % for both medium and low viability . In camels , 32 % of viability was medium and 20 % and 18 % were low and high viability (Table 19) .

Table 15 : Classification of hydatid cysts of examined sheep , goats , cattle and camels according to their fertility and physical contents .

Hydatid cyst categories	Sheep	Goats	Cattle	Camels
	N (%)	N (%)	N (%)	N (%)
Fertile	36 (72.0)	29 (58.0)	0 (0.0)	35 (70.0)
Sterile	8 (16.0)	13 (26.0)	35 (70.0)	9 (18.0)
Calcified	2 (4.0)	4 (8.0)	7 (14.0)	2 (4.0)
Caseous	4 (8.0)	4 (8.0)	8 (16.0)	4 (8.0)
Total	50	50	50	50

$X^2 = 71.054$, $P < 0.05$, $df = 9$, p-value = 0.000 ***

Figure 15 : Fertility of hydatid cyst from examined sheep , goats , cattle and camels .

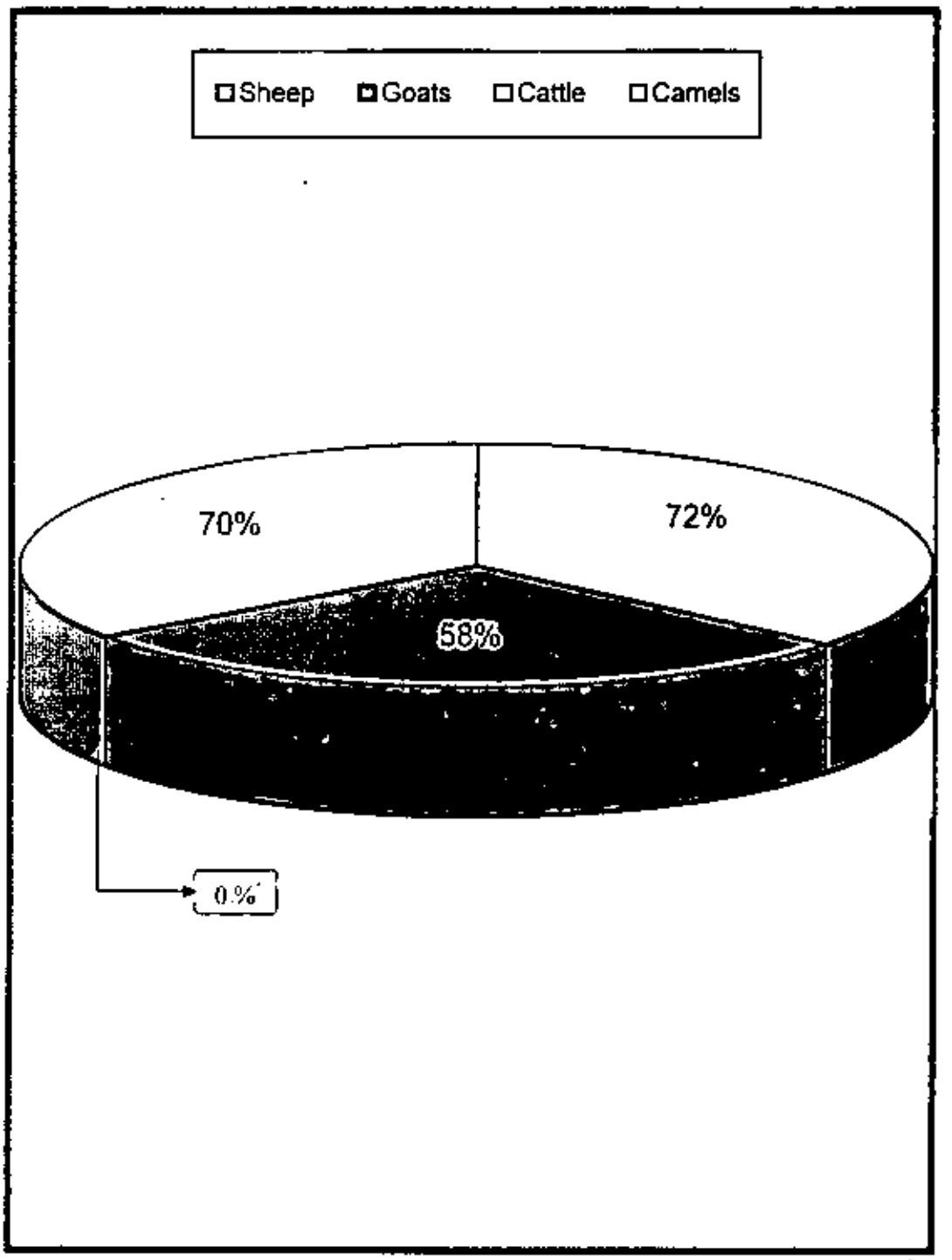


Table 16 : The fertility of hydatid cyst of examined sheep , goats , cattle and camels according to their age .

Examined animals	Fertility according to age (years)				P-value
	<1 (%)	1-<2 (%)	2-<3 (%)	≥3 (%)	
Sheep	7 (70.0)	7 (70.0)	7 (53.8)	15 (88.2)	0.517
Goats	40 (33.3)	7 (77.8)	7 (50.0)	11 (73.3)	0.354
Camels	4 (66.7)	7 (58.3)	11 (68.8)	7 (70.0)	0.542

Table 17 : The fertility of hydatid cysts of examined sheep , goats and camels according to their sex .

Hydatid cyst categories	Sheep		Goats		Camels	
	Males	Females	Males	Females	Males	Females
No. of cysts	25	25	22	28	21	29
Fertility (%)	18 (72.0)	18 (72.0)	13 (59.1)	16 (57.1)	16 (76.2)	19 (65.5)
p-value	0.759 (Non-sig)		0.658 (Non-sig)		0.436 (Non-sig)	

Table 18 : Comparsion between the fertility of hydatid cysts in liver and lungs of sheep , goats and camels .

Examined animals	Fertile cysts				p-value
	Liver		Lungs		
	No.	Fertile	No.	Fertile	
Sheep	30	25 (83.3)	20	11 (55.0)	0.759
Goats	24	12 (50.0)	26	17 (65.4)	0.521
Camels	30	22 (73.3)	20	13 (65.0)	0.641

Table 19 : Comparsion between the viability of hydatid cyst protoscoleces from liver,lungs of sheep,goats and camels.

Examined animalsx	Viability				Unviable
	No. of cysts	5-40 %	41-60 %	61-100 %	
Sheep	50	6 (12.0)	10 (20.0)	19 (38.0)	15 (30.0)
Goats	50	8 (16.0)	8 (16.0)	13 (26.0)	21 (42.0)
Camels	50	10 (20.0)	16 (32.0)	9 (18.0)	15 (30.0)

4.4.5 Viability of cysts and age :

The results showed that there was no significant difference between viability of protoscoleces and age groups of all animal species , sheep (P = 0.244) , goats (P = 0.833) and camels (P = 0.248) (Table 20) .

4.4.6 Viability of cysts and sex :

There was no significant relationship between the viability of hydatid cyst and sex of infected sheep (P =0.881) goats (P = 0.563) and camels (P = 0.187) (Table 21) .

4.4.7 Viability of cysts and infected organs :

Fifty hydatid cysts of infected liver and lungs from sheep , goats and camels were examined for viability of protoscoleces . Both organs showed viable cysts , liver cysts showed 80 % and lungs 55 % in sheep , whereas 50 % and 65 % in liver and lungs of goats and liver and lungs of camels showed 76 % and 62 % of viable cysts respectively . The difference in the viability between two organs was insignificant (P>0.01) (Table 22) .

4.4.8 Viability of cysts and cyst size :

Viable protoscoleces were detected in all sizes of hydatid cysts from sheep , goats and camels . There is a significant difference between the viability of protoscoleces and cyst sizes in sheep (P = 0.046) in goats (P = 0.042) and in camels (P = 0.048) (Table 23) .

4.5 Measurement of protoscoleces :

Two hundred protoscoleces were examined and measured from each . organ (liver and lungs) of sheep, goats and camels (Table 24) . Total length of protoscoleces of liver and lungs in sheep were found to be

Table 20 : The viability of cyst protoscoleces of examined sheep , goats and camels according to their age .

Examined animals	Age (Years)	Viability % (N)					p-value
		No. of cysts	5-40 %	41-60 %	61-100 %	Total viable cysts (%)	
Sheep	<1	10	6(60.0)	1 (10.0)	0 (0.0)	7(70.0)	0.244
	1-<2	10	0 (0.0)	4(40.0)	2(20.0)	6(60.0)	
	2-<3	13	0 (0.0)	1 (7.7)	6(64.2)	7(53.8)	
	≥3	17	0 (0.0)	4 (23.5)	11(64.7)	15(88.2)	
Goats	<1	12	2(16.7)	2(16.7)	0 (0.0)	4(33.3)	0.833
	1-<2	9	5(55.6)	2(22.2)	0 (0.0)	7(77.8)	
	2-<3	14	0 (0.0)	4(28.6)	3(21.4)	7(50.0)	
	≥3	15	1 (6.7)	0 (0.0)	10(66.7)	11(73.3)	
Camels	<1	10	6(60.0)	1 (10.0)	0 (0.0)	7(70.0)	0.248
	1-<2	10	0 (0.0)	4(40.0)	2(20.0)	6(60.0)	
	2-<3	13	0 (0.0)	1 (7.7)	6(46.2)	7(53.8)	
	≥3	17	0 (0.0)	4(23.5)	11(64.7)	15(88.2)	

Table 21 : The viability of cyst protoscoleces of examined sheep , goats and camels according to their sex .

Examined animals	Sex	Viability					p-value
		No. of cysts	5-40 %	41-60 %	61-100 %	Total viable cysts %	
Sheep	Males	25	1 (4.0)	7(28.0)	10(40.0)	18(72.0)	0.881
	Females	25	5(20.0)	3(12.0)	9(36.0)	17(68.0)	
Goats	Males	22	4(18.2)	5(22.7)	4(18.2)	13(59.0)	0.563
	Females	28	4(14.3)	3(10.7)	9(32.1)	16(57.0)	
Camels	Males	21	6(28.6)	7(33.3)	3(14.3)	16(76.0)	0.187
	Females	29	4(13.8)	9(31.0)	6(20.7)	19(65.5)	

Table 22 : The viability of hydatid cyst protoscoleces in liver and lungs of examined sheep , goats and camels .

Examined animals	Location	Viability % (N)					p-value
		No. of cysts	5-40 %	41-60 %	61-100 %	Total viable cysts %	
Sheep	Liver	30	4(13.3)	5(16.7)	15(50.0)	24(80.0)	0.350
	Lungs	20	2(10.0)	5(25.0)	4(20.0)	11(55.0)	
Goats	Liver	24	3(12.5)	2(8.3)	7(29.2)	12(50.0)	0.170
	Lungs	26	5(19.2)	6(23.1)	6(23.1)	17(65.0)	
Camels	Liver	29	6(20.7)	9(31.0)	7(24.1)	22(76.0)	0.658
	Lungs	21	4(19.0)	7(33.3)	2(9.5)	13(62.0)	

Table 23 : The viability of cyst protoscoleces in examined sheep , goats and camels according to the cyst size.

Examined animals	Cyst size	No. of cysts	Viability				p-value
			5-40 %	41-60 %	61-100 %	Total viable cysts %	
Sheep	<2 cm	19	3(15.8)	3(15.8)	0 (0.0)	6(31.6)	0.046*
	2-5 cm	25	3(12.0)	6(24.0)	15(60.0)	24(96.0)	
	6-10cm	6	0 (0.0)	1(16.7)	4(66.7)	5(83.3)	
	11-20cm	20	3(15.0)	1 (5.0)	2(10.0)	6(30.0)	
Goats	<2cm	21	5(23.8)	5(23.8)	6(28.6)	16(76.2)	0.042*
	2-5cm	4	0 (0.0)	1(25.0)	2(50.0)	3(75.0)	
	6-10cm	5	0 (0.0)	1 (20.0)	3(60.0)	4 (80.0)	
	11-20cm	19	3(15.8)	3(15.8)	0 (0.0)	6 (31.6)	
Camels	<2cm	31	10(32.3)	11(35.5)	0 (0.0)	21(67.7)	0.048*
	2-5cm	11	0 (0.0)	3(27.3)	4(36.4)	7(63.6)	
	6-10cm	8	0 (0.0)	2(25.0)	5(62.5)	7(87.5)	
	11-20cm	31	10(32.3)	11(35.5)	0 (0.0)	21(67.7)	

132.7-226.9 µm (Ave. 180.5) and 103.8 – 186.8 µm (Ave. 171.3 µm) respectively . and in goats the measurement of protoscoleces were 120.6 – 256.7 µm (Ave. 181.1µm) and 113.5 – 272.7 µm (Ave. 174.8 µm) in liver and lungs , whereas in camels were 171.2 – 334.7 µm (Ave. 235.2 µm and 230.3 – 253.1 µm (Ave. 237.2 µm) . The width of protoscoleces from liver and lungs were 92.3 –238.6 µm (Ave.145.2µm) and 95.7 – 226.8 µm (Ave. 145.7µm) in sheep , 97.2 – 216.4 µm (Ave. 155.9 µm) and 102.2 – 215.5 µm (Ave. 150.9 µm) in goats whereas 124.6 – 277.4 µm (Ave. 195.1µm) and 103.2 – 282.9 µm (Ave. 202.2 µm) in camels respectively .

Characteristic arrangement of rostellum hooks was clearly seen in viable cysts from liver and lungs and the total number of hooks per protoscoleces were found 28-38 (mean 32.6) in sheep ,28 -42 (mean 33.9) in goats and 26 – 41 (mean 34.1) in camels . There is no differences between the number of hooks of liver and lung cyst in each animal species and between sheep , goats and camels .

4.5.1 Rostellum hooks :

The dimensions of small and large hooks are shown in Table (25) . Differences between hooks in both liver and lungs were detected . Among large hooks the average total length was 23.9 µm , 22.8 µm and 24.5 µm , blade length was , 13.6 µm , 14.1 µm and 11.7 µm , handle length was 9.9 µm, 9.2 µm and 9.9 µm, hook's width was 7.4 µm, 8.1 µm and 8.3 µm in sheep , goats and camels respectively . While small hooks showed average total length 19.6 µm , 20.9 µm and 20.9 µm , blade length 11.7 µm , 12.7 µm and 12.3 µm , handle length 8.3 µm , 8.3 and 7.3 µm , hook's width was 7.2 µm , 7.2 µm and 6.4 µm in sheep , goats and camels respectively . There were no significant differences between rostellum hooks measurements and animal species (Plate 21) .

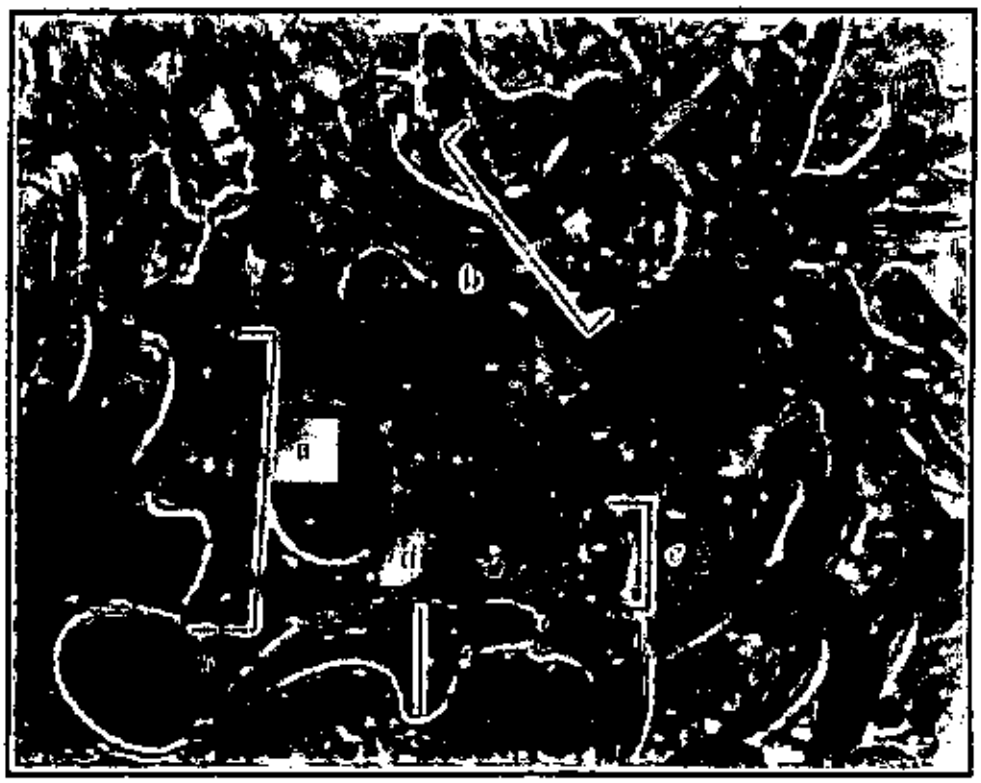


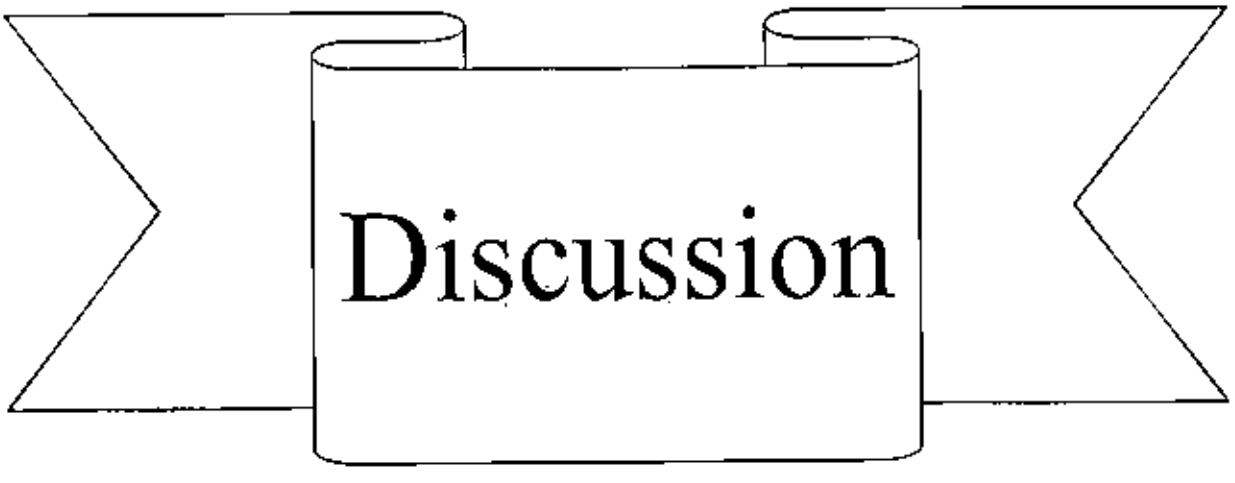
Plate 21 : Rostellum hooks from cyst showing measurement recorded X = 100 (a) Total length , (b) Blade length , (c) Handle length , (d) Hook width .

Table 24 : Measurement of protoscoleces and total number of their hooks from liver and lungs of examined sheep , goats and camels .

Examined animals .	Organ	No. of cysts examined	No. of protoscoleces examined	Measurement of protoscoleces				Number of hooks / scolex	
				Total length (µm)		Total width (µm)			
				Range	Mean	Range	Mean	Range	Mean
Sheep	Liver	25	200	132.7-226.9	180.5	92.3-238.6	145.2	28 – 38	32.9
	Lungs	25	200	103.8-186.8	171.3	95.7-226.8	145.7	28 – 38	32.2
Goats	Liver	25	200	120.6-256.7	181.1	97.2-216.4	155.9	28 – 42	33.1
	Lungs	25	200	113.5-272.7	174.8	102.2-215.5	150.9	29 – 41	34.6
Camels	Liver	25	200	171.2-334.7	235.2	124.6-277.4	195.1	26 – 41	34.1
	Lungs	25	200	230.3-253.1	237.2	103.2-282.9	202.2	25 – 40	34.2

Table 25 : Measurements of rostellum hooks from hydatid cysts of sheep , goats and camels .

Animal type / Rostellar hooks	Sheep	Goats	Camels
Large hooks	**N = 200**	**N = 200**	**N = 200**
Hook's total length	23.9 (21.2 – 25.5) µm	22.8 (20.1 – 27.3) µm	24.5 (23.1 – 26.6) µm
Blade length	13.6 (14.3 – 16.1) µm	14.1 (10.8 – 16.7) µm	11.7 (10.7 – 15.9) µm
Handle length	9.9 (7.8 – 11.1) µm	9.2 (8.4 – 10.8) µm	9.9 (8.2 – 11.6) µm
Hook's width	7.4 (6.5 – 8.6) µm	8.1 (7.3 – 9.7) µm	8.3 (6.3 – 10.2) µm
Small hooks	**N = 200**	**N = 200**	**N = 200**
Hook's total length	19.6 (18.5 – 23.9) µm	20.9 (18.6 – 25.2) µm	20.9 (18.1 – 22.8) µm
Blade length	11.7 (10.4 – 15.1) µm	12.7 (10.8 – 15.6) µm	12.3 (9.5 – 15.3) µm
Handle length	8.3 (7 – 10.6) µm	8.3 (7.3 – 9.8) µm	7.3 (5.5 – 8.4) µm
Hook's width	7.2 (6.5 – 9.9) µm	7.2 (7.5 – 8.7) µm	6.4 (5.2 – 9.1) µm


Discussion

5. DISCUSSION

This study was carried out to display the prevalence of echinococcosis among domestic animals at Sirt city . From the epidemiological point of view echinococcosis is a cyclozoonotic infection having a worldwide distribution and a variable geographic incidence (Williams *et al.*, 1971) . The incidence in any country is closely related to prevalence of the disease in domestic animals (Craig *et al.*, 1995 and Gottstein , 2000) .

It is well established that hydatid disease is an important health problem and livestock economy in Libya (Dar and Taguri , 1979 ; Gebreel *et al.*, 1983 ; Gusbi *et al.*, 1987 and Shaafie *et al.*, 1999) . The prevalence of hydatid cysts in intermediate hosts provides an indicator of all degree of pasture contamination with *Echinococcus* eggs released in dog faeces (Schwabe , 1968) .

5.1 Prevalence :

The hydatid cysts of *E. granulosus* were detected in all examined animal . These animals included sheep , goats , cattle and camels . This finding are in agreement with previous studies in Libya (Gebreel *et al.*, 1983 ; Gusbi *et al.*, 1987 ; Ahmed *et al.*, 1996 ; Ibrahem and Gusbi , 1997; Al-Saqur *et al.*, 2001) , Aboudaya (1985a) ; Tashani *et al.* (2002) and Mohamed *et al.* (2004) .

5.1.1 Sheep :

The results have showed that the prevalence of hydatid cysts in slaughtered sheep was found to be 4.9 % in Sirt . This result came in agreement with the prevalence rates reported from different localities in Libya , the incidence of hydatidosis in sheep during 1975 and 1977 was

3.1% and 3.3 % respectively (Dar and Taguri , 1979) . Other study for the same period revealed that 3.08 % and 3.34 % of slaughtered sheep were infected (Gebreel *et al.*, 1983) . Aboudaya (1985a) collected data of hydatid cysts slaughtered sheep in 46 abattoirs distributed throughout Libya and he found the prevalence in sheep was 4.3 % . The lower prevalence of hydatidosis in examined sheep seen in the present study have been reported from other countries , southern Morocco (5.3%) (Pandey *et al.*, 1988) , central Jordan (1.3 %) (Dajani and Khalaf , 1981) , central Iraq (5.9 %) (Al-Abbassy *et al.*, 1980) , northwestern Morocco (0.7 %) (Pandey *et al.*, 1986) .

While the high prevalence in sheep throughout the country was done by Gusbi *et al.* (1987) given an overall prevalence at 12.74 % . Ibrahem and Craig (1998) reported that 15.6 % of slaughtered sheep from Benghazi were infected with hydatidosis . In a recent study , Al-Saqur *et al.* (2001) reported that 14.3 % of sheep were infected with hydatid cysts in Sebha . The prevalence of hydatid disease in sheep from Benghazi was found to be 20 % (Tashani *et al.*, 2002) and from Sebha was 18.5 % (Mohamed *et al.*, 2004) and from other countries , from north and central Tunisia (65.6 %) (Lahmar *et al.*, 1999) , southern Morocco (44.6 %) (Pandey *et al.*, 1988) northern Jordan (28 %) (Abdel-Hafez *et al.*, 1986a), northwestern Iran (19.1 %) (Nourian *et al.*, 1997) and northern Iraq (15 %) (Saeed *et al.*, 2000) .

5.1.2 Goats :

The prevalence of hydatidosis in examined goats from Sirt was found to be 2.4 %. This result is consistent with those reported from other regions of Libya , from Benghazi was reported to be 5.5 % (Dar and Taguri , 1979) , 5.5% (Ibrahem and Craig , 1998) , 3.4% (Tashni *et al.*,

2002). Gusbi *et al.* (1990) reported that the infection was 1.5 % throughout the country . The infection were 8.2 % and 5.8 % in goats from Sirt and El-Kumes respectively (Ibrahem and Craig , 1998) and 4% from Sebha (Mohamed *et al.*, 2004) . Similarly low infection rates of hydatidosis in goats have been reported from other countries , Syria (2.3%) (Dajani , 1978) , central Iraq (5.1 %) (Al-Abbassy *et al.*, 1980) , central Jordan (0.54 %) (Dajani and Khalaf , 1981) , northern Jordan (3.6%) (Al-Yaman *et al.*, 1985) , Kenya (7.1 %) (Macpherson , 1985) , northwestern Morocco (1.4 %) (Pandey *et al.*, 1986) , India (1.9 %) (Irshadullah *et al.*, 1989) and northern Iraq (6.2 %) (Saeed *et al.*, 2000) .

High infection was reported from Benghazi at 18.1 % (Gebreel *et al* ., 1983) . The low infection rate in goats may due to the feeding behaviour of this animal , they feed on the upper parts of plants which decrease the chance of these animals to ingest the *Echinococcus* eggs , which usually on the pasture and lower parts of plants , this was reported by Cousi (1951) , Pandey *et al.* (1986) , Euzéby (1991) , Tashani *et al.* (2002) and Mohamed *et al.* (2004) .

5.1.3 Cattle :

Prevalence in cattle in the present study was 15 % , this result was significantly higher than that in sheep , goats and camels . The prevalence of hydatidosis in cattle in Benghazi during the years of 1975 , 1976 and 1977 was 8.9 %, 10.6 % and 13.9 % respectively Dar and Taguri (1979) and Gebreel *et al* ., 1983) . while a nationwide study revealed that the prevalence of hydatidosis in cattle was found to be from 0.7 % to 37 % (Aboudaya , 1985a) . Gusbi *et al.* (1990) recorded that infection rate in cattle from Tripoli was 5.7 % . The prevalence rate of *E. granulosus* in cattle from Benghazi was11 % (Tashani *et al.*, 2002) . On the other hand

Mohamed *et al.* (2004) reported the same prevalence obtained in the present study in cattle (15 %) from Sebha .

Similar and different infection rates in cattle have been recorded from various parts of the world . The previous studies revealed that high infection rates were recorded from Bangladesh (42.15 %) (Islam , 1982) , Morocco (44.6 %) (Pandey *et al.*, 1988) and northwestern Iran (22 %) (Nourian *et al.*, 1997) . On the other hand low prevalence rates of hydatidosis in cattle were reported from Kano state , Nigeria (14.7 %) (Dada *et al.*, 1980) , central Iraq (4.9 %) (Al-Abbassy *et al.*, 1980) , northern Jordan (11.4 %) (Al-Yaman *et al.*, 1985) , Kenya (8.9 %) (Macpherson , 1985) , northern Iraq (10.9 %) (Saeed *et al.*, 2000) .

5.1.4 Camels :

The prevalence of hydatidosis in examined camels was 2.7 % . This result came in agreement with those the results obtained by Dar and and Taguri (1979) at 1.41 % , Gebreel *et al* . (1983) at 1.48 % , Khan and El-Buni (1999) in Benghazi at 1.97 % and Gdourra (2003) in Sirt at 3.62 % . Dar and Taguri (1979) reported that the prevalence rate in camels during the years 1976 and 1977 was 34.7 % and 29.10 % respectively . During the same years Gebreel *et al.* (1983) made a study on *Echinococcosis* in Libya and revealed that the prevalence was detected at 17.6 % and 29.1% respectively . However , many reports shows that hydatidosis in camels was highly endemic in Libya 27.20 % (Aboudaya , 1985a) , 5.9 % (Gusbi *et al.*, 1987 , 1990) , 48.4 % in Sebha (Ahmed *et al.*, 1996) , 48 % (Ibrahem and Craig , 1998) , 13.6 % (Tashani *et al.*, 2002) and 12.62 % (Mohamed *et al.*, 2004) . On the other hand high prevalence of hydatidosis in camels was reported in Kufra at 50.6% (Gusbi *et al.*, 1990).

Ibrahem and Craig (1998) reported that the prevalence of hydatidosis in camels from six slaughter houses in northern Libya was found to be 48 % , the prevalence in these six localities were 55 % in Mesurate , 49.5 % in Sirt , 47.5 % in Tripoli , 42.4 % in El-Khumes , and 38.7 % in Zawia . Gusbi *et al.* (1990) reported that the prevalence was 36.2 % in camels from Benghazi . The high infection prevalence rates of hydatidosis in camels included in the previous studies may due to those camels were brought from various regions within the country in addition to those imported camels to Libya from its neighbours such as Sudan , Tunisia , Niger and Chad , where hydatidosis had been reported in these countries , 45.4 % in camels from Sudan (Saad *et al.*, 1983) , 66 % in Tunisian camels (Ben Osman , 1965) and 22 % in Niger camels (Develoux *et al.*, 1985) . In Egypt , Haridy *et al.* (1998) among camels imported from Sudan for human consumption over five years reported 5.5 % (1992) , 6.1 % (1993) , 6.7 % (1994) , 8.2 % (1995) and 4.3 % (1996) . On the other hand low infection rate recorded may explained by those camels are brought to slaughter from restricted area specially around Sirt or due to the large number of young camels in the examined samples .

Hydatid disease in camels have been reported from other countries , these results may be similar or higher than that seen in Libya , such results were 20.4 % in central Iraq (Al-Abbassy *et al.*, 1980) , 8.8 % in northern Jordan (Al-Yaman *et al.*, 1985) and high infection a 80 % in Morocco (Pandey *et al.*, 1986) .Generally speaking , in various African countries , camels (*C. dromedaries*) was infected with hydatid cysts of *E. granulosus* . This recommended that camels are reservoir for humans infection (Hamdy *et al.*, 1980 and Macpherson *et al.*, 1986) .

5.1.5 Prevalence and sex :

Both sexes of all animal species examined in the present study were found to be infected with hydatidosis . No significant differences were found between infected male and female sheep . Both sexes have shown nearly the same rate of susceptibility to the infection . This disagree with other authors , who found that females sheep were infected more than males (Pandey *et al.*, 1988 and Tashani *et al.*, 2002) .

The prevalence rate in both male and female examined sheep in the present study may explain the susceptibility of both sexes to infection . On the other hand hydatidosis was more prevalent in females than males goats . While no significant differences were shown between both sexes of cattle . The result revealed that there was a significant difference of hydatidosis between sexes of camels . Al-Yaman *et al.* (1985) reported that female camels from northern Jordan were significantly more infected than males . A study conducted by Mohamed *et al.* (2004) in Sebha revealed that no significant differences were found between infected male and female and both sexes have shown the same susceptibility to infection with *E. granulosus* .

5.1.6 Prevalence and age :

The prevalence rates were increased with age in all examined animal species . This finding was demonstrated in many animal species (Al-Yaman *et al.*, 1985 ; Pandey *et al.*, 1986 ; Roberts *et al.*, 1986 and Tashani *et al.*, 2002) .

The older sheep had higher prevalence than young . The same situation was seen in sheep for the prevalence of adult sheep in Libya (Gusbi *et al.*, 1987 and Tashani *et al.*, 2002), in Tunisia (Lahmar *et al.*,

1999) . The same trend was seen in goats and cattle , there is a strong correlation and significant difference between age groups of goats . An increase of prevalence with age was shown to occur in camels (Ibrahem and Craig , 1998 ; Tashani *et al.*, 2002 and Mohamed *et al.*, 2004) . This finding disagree with results obtained by Gdourra (2003) , the results showed that the infection of camels with hydatid cysts did not increase with age .The increase of infection rates with age may due to the older animals passed through a longer period of exposure to *Echinococcus* eggs and slow development of hydatid cysts take a longer time and easily detected in old animals . This situation have be reported in previous studies (Al-Abbassy *et al.*, 1980 ; Islam , 1982 ; Al-Yaman *et al.*, 1985; Pandey *et al.*, 1988 ; Irshadulla *etal.*, 1989 and Abo-Shehada , 1993) .

5.1.7 Prevalence and seasons :

The season have no effect on the infection rate of hydatid cysts in all examined animal species . This may explained by those animals exposed to the *Echinococcus* eggs at the same degree over the year . Dyab *et al.* (2005) reported that prevalence of hydatid cysts in Egypt during Summer or Autumn was higher than during Winter or Spring .

5.1.8 Location of hydatid cysts :

The most commonly infected organs in all examined animal were liver and lungs . Liver was the most predominate site for hydatid cysts in sheep , goats and cattle . A similar findings reported in Libya (Gusbi *et al.*,1987 , 1990 ; Tashani *et al.*, 2002) , in Middle East and Mediterranean , countries in north Jordan (Al-Yaman *et al.*, 1985) , in Tunisia (Lahmar *et al.*, 1999) , in northern Iraq (Saeed *et al.*, 2000) . On other hand , the lung was more infected than liver in sheep , cattle , goats and camels from Morocco (Pandey *et al.*, 1988) , Egypt (Haridy *et al.*, 2000) .

The lungs was found to be the most infected organ in the camels . This phenomenon was also reported from Jordan (Al-Yaman *et al.*, 1985) , Morocco (Pandey *et al.*, 1986) , Libya (Gusbi *et al.*, 1990) , Egypt (Abou-Aisha , 1999 and Haridy *et al.*, 1998 , 2000) This disagree with the results obtained by Gdourra (2003) in Sirt , the results showed that the liver was the most infected site for hydatid cysts in camels . It seems that the narrow size of lung capillaries and sponge texture of its tissue pave the way for the onchospheres to develop into cysts (Dyab *et al.*, 2005) . Thompson *et al.*, (1995) mention that an atomical structure and physiological characters of the host as well as the species and strain of parasite may explain the locations of cystic echinococcosis in various organs of intermediate hosts. On the other hand , Muller (2002) suggested that the highly lung infection with hydatid cysts my due to the possibility of infection occurs directly through the respiratory tract from *Echinococcus* eggs blown in dust by the wind . This situation may occurs in Libya .

The present study revealed that the sex had no effect on location of hydatid cysts in sheep , cattle and camels , while there is a significant difference between sex of goats and location of hydatid cysts . However age had effect on the location of cysts in sheep and goats , but such effect do not detected in cattle and camels . Harris *et al.* (1989) mentioned that the location of onchospheres may had further influenced by the age of animal at the time of exposure to infection .

5.1.9 Intensity of infection :

The majority of all examined animal showed light intensity of infection . This in agreement with many previous results (Al-Yaman *et al.*, 1985 ; Pandey *et al.*, 1986 ; Gusbi *et al.*, 1990 ; Ibrahem and Craig ,

1998 ; Tashani *et al.*, 2002 and Mohamed *et al.*, 2004) . The intensity of infection in different organs of various intermediate hosts have been reported from different countries , from northern Jordan (Al-Yaman *et al.*, 1985 and Abdel-Hafez *et al.*, 1986b) and from Morocco (Pandey *et al.*, 1986 ; 1988) in both countries the results revealed that the intensity was higher in camel lungs . On the other hand Ibrahem and Craig (1998) reported that the intensity of infection increase with animal age .

5.2 Hydatid cyst characteristics .

5.2.1 Size of hydatid cysts :

The size of hydatid cysts for examined animal species are varied in dimensions . The dimension of cysts in the liver and lungs of sheep , cattle and camels ranged from <2 cm to a maximum 10 cm , while in goats from <2 cm to a maximum 20 cm . Tashani *et al.* (2002) reported that the dimensions of cysts in the liver and lungs of sheep were similar and the same observations were seen in goats and camels cysts . In the present study infected goats had the largest hydatid cysts . This finding was observed in cattle and camels (Tashani *et al.*, 2002) . The size of hydatid cysts is controlled by the organ in which it grows (Gusbi *et al.*, 1991) .

The result showed that the cyst size increase with age in sheep , which agrees with the results obtained by Morris and Richards (1992) ; Ibrahem and Craig (1998) and Tashani *et al.* (2002) . On the other hand , no relation between the size of the hydatid cysts and age in cattle was seen in Morocco (Pandey *et al.*, 1988) . The cyst size and age was poorly correlated in the case of cattle and camels , however goat cysts decrease in size with age increase (Tashani *et al.*, 2002) .

5.2.2 Fertility of hydatid cysts :

The percentage of fertility of sheep , goats , cattle and camels were 72 % , 58 % , 0.00 % and 70 % respectively . Sheep had the lowest sterile cysts (16 %) followed by camels (18 %) and goats (26%) while in cattle (70%) . This observation is consistent with results previously reported in Libya , in sheep (69 %) , cattle (14 %) and camels (51.7 %) respectively (Tashani *et al.*, 2002) . Haridy *et al.* (1998) reported that fertility was 49 % in camels from Egypt , and Wilson and Rausch (1980) put the fertility at 92 % in sheep and 80 % in cattle . High hydatid cyst fertility in camels was reported in northern Africa (Abdul-Salam and Farah , 1988 ; Gusbi *et al.*, 1987 ; 1990 ; Ibrahem and Craig , 1998) .

The examined livers of sheep and camels had more fertile cysts than lungs . In Egypt , Haridy *et al.* (1998) reported a fertility of 29 % in cysts of lungs and 20 % in liver cysts of camels . In sheep slaughtered in Egypt , Haridy *et al.* (2000) reported that the cysts in the lungs and the liver of sheep showed a fertility of 50 % and 40 % respectively . Ibrahem and Craig (1998) showed camel cysts (99.6 %) more fertile than sheep cysts (86.3 %) without mention the percentage in infected organs in the same study they reported that 71.4 % of fertile liver cysts and zero lung infection in goats . Many previous studies reported differences in fertility of liver and lungs hydatid cysts in intermediate hosts from different countries (Al-Abbassy *et al.*, 1980 ; Pandey *et al.*, 1988 ; Irshadulla *et al.*, 1989 ; Mohamed *et al.* , 1997 ; Abou-Aisha , 1999 and Khan *et al.*, 2001).

5.2.3 Viability of hydatid cyst protoscoleces :

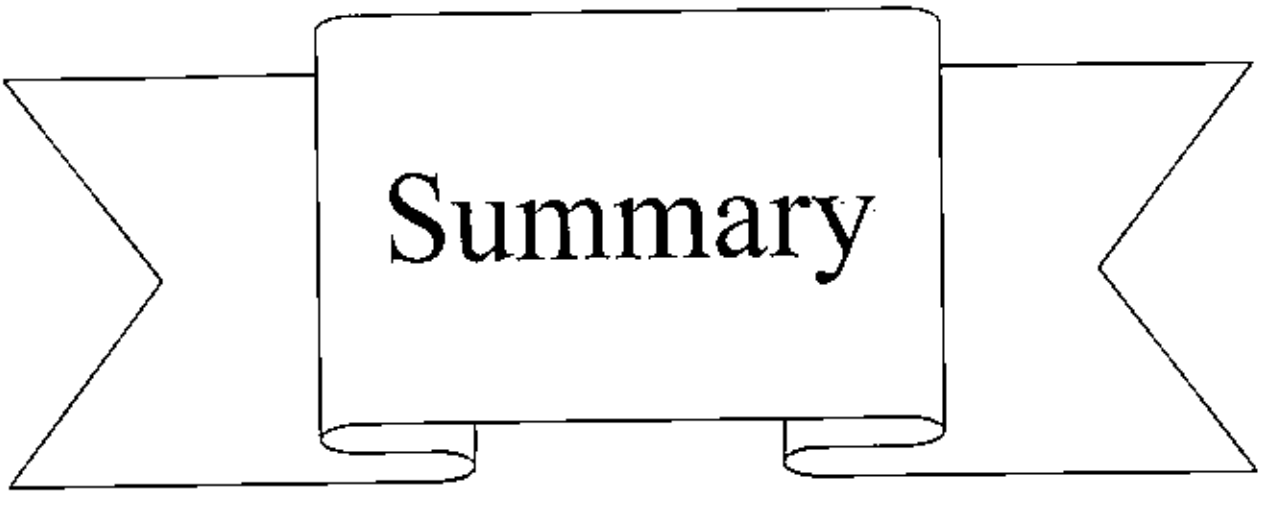
The viability of hydatid cysts in the sheep and camels was similar (70%) . While in goats was lower (58 %) . The viability of sheep liver cysts (83.3 %) was higher than lung cysts (55 %) , the same situation for camels , the viability of liver cysts was 73.3 % and lungs cysts was 65 % . However goat lung cysts (65 %) was higher than that in the liver (50 %) . Irshadulla *et al.* (1989) and Mohamed *et al.* (2004) reported that the viability of camel lung cysts was higher than that in liver . Himonas *et al.* (1994) reported the same result in cattle in Greece . However , Tashani *et al.* (2002) reported that sheep liver cysts are more viable than lung cysts , while in camels , the viability of camel cysts (76%) was higher than that of lung cysts (45.5%) .

The absence of reports on percentage of viability of *E. granulosus* cysts in intermediate hosts in Libya made the comparisons to be difficult . El-Sageyer and Kidwai (1993) reported the viability of hydatid cysts in sheep in Benghazi . The viability of hydatid cysts in sheep increased with age . The viability of cysts increased with increasing the cyst size in camels . While in sheep and goats the viability decreased with cyst size increased . Abdel-Hafez *et al.* (1986b) reported that the viability increased with increasing the cyst size in sheep . No significant influence of sex on the viability of cysts in sheep , goats and camels (P=0.881) . This finding is in agreed with results reported by Abdel-Hafez *et al.* (1986b) and Mohamed *et al.* (2004) .

5.2.4 Measurements of protoscoleces and rostellar hooks :

The size of protoscoleces from sheep and goats nearly similar , while those from camels quite different , and larger than protoscoleces from sheep and goats . There was no significant difference in the size of

rostellum hooks from liver and lungs in various examined animal species, the same finding was reported by Tashani *et al.* (2002) . Variations in hook measurments was reported by Daily and Sweatman (1965) . Many studies have been done to characterize the strain of *E. granulosus* by using hook morphology alone were not successful (Hobbs *et al.*, 1990) . Constantine *et al.* (1993) and El-Sageyer and Kidwai (1993) .


Summary

SUMMARY

A total of 3794 sheep , 8123 goats 113 cattle and 739 camels slaughtered at Sirt abattoir were examined for hydatid cysts of *Echinococcus granulosus* . The prevalence of hydatid cysts in these animals was found to be 4.9 % , 2.4 % , 15 % , and 2.7 % respectively .

The infection with hyadtid cysts was detected in both males and females of all examined animal species . The result showed that the prevalence in male sheep was 5.9 % and female was 4.4 % .No significant differences in prevalence of hydatidosis between both sexes (P= 0.58) . The prevalence in females goats (3.9 %) was higher than in males (1.8 %) (P=0.000) . The prevalence in male and female cattle was 12.9 % and 18.6 % respectively . No significant differences between both sexes of cattle (P = 0.411) . However there was a slight correlation and significant difference (P = 0.044) in prevalence of hydatidosis between male (1.7 %) and female (4.1 %) camels .

The infection with hydatidosis was age dependent in sheep and goats , the infection increase with age . There are significant differences between the prevalence and age groups in sheep (P=0.000) and goats (P=0.000) . Prevalence in cattle older than 3 years was 22.7 % higher than 1 year old (2.1 %) and 1 – 2 years old (14.3 %) . The infection with hydatid cysts in camels increased with age . The differences between age groups were statistically significant (P = 0.000) .

The results showed that there is no correlation and significant difference in prevalence and seasons (winter , spring , summer and Autumn) .

Single infection was recorded in liver (51 %) , lungs (22.6 %) and mixed was (26.3 %) in sheep . In goats the single infection was 39 % in liver , 27.7% in lungs and mixed infection was 33 % in both organs together . Infection in camel lungs (50%) was higher than liver (25 %) , while infection in both organs was 25 % . In sheep liver infection (77.9 %) was higher than lungs (48.9 %) . Goats liver had 72.3 % of infection and lungs 60 % . Cattle liver infection was 64.7 % and lungs 58 % . However , lungs of camels (75 %) more infected than liver (50 %) .

The sex had no effect on location of cysts in sheep , cattle and camels . However , there is a significant difference between sex of goats and location of cysts (P = 0.011) . There was a significant difference between age and location of cysts in sheep and goats (P = 0.000) , but this finding do not detected in cattle and camels .

Intensity of infection was correlated and a significant in different age groups in sheep and goats (P = 0.000) , but it is not in cattle (P=0.699) and camels (P = 0.053) . The sex of examined animals had no effect on the intensity of infection .

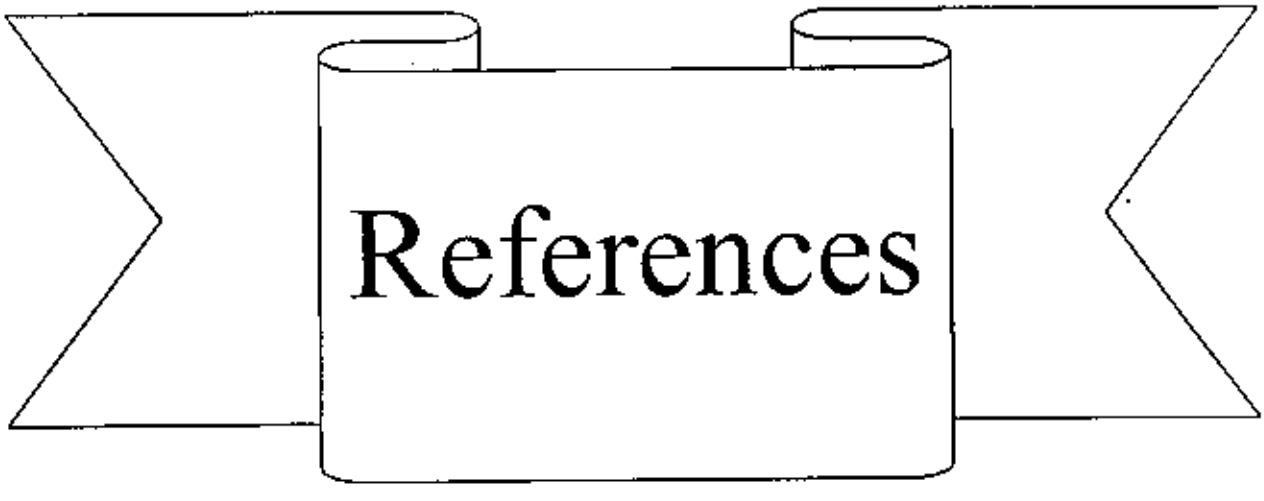
The most of hydatid cysts in sheep were found in liver (56.7 %) in the size (2 – 5 cm) , whereas , those found in lungs (45.1 %) medium small size (> 2cm) . 45.8 % of goats liver had medium size , while 42.8% of lungs had small size . Large hydatid cysts (5 – 10 cm) were found only in liver (4.2 %) and lungs (15.4 %) of goats . In cattle and camels , the most hydatid cysts of small size were found in liver and lungs .

The physical content of hydatid cysts was fluid , caseous and classified .The fertility of hydatid cysts in examined animals were 72 % , 58 % , 0.00 % and 70 % in sheep , goats , cattle and camels respectively . All cysts of cattle were sterile . The sheep and camels liver had more fertile cysts than lungs . Age groups had no effect on the cyst fertility in each examined animal species ($P > 0.05$) .

There was no correlation between viability of hydatid cysts and age or sex of sheep , goats , cattle and camels . The differences in the viability between liver and lungs of all examined animals were insignificant ($P=0.01$) . However there is a significant difference between viability and cyst size in sheep ($P = 0.046$) , goats ($P = 0.042$) and camels (P 0.048) .

The average length of protoscoleces of liver in sheep , goats and camels were 180.5 µm , 181.1 µm and 235.2 µm respectively . Large protoscoleces were noted among those isolated from hydatid cysts of camels .

Characteristic arrangement of rostellar hooks was clearly seen in viable cysts from liver and lungs . There was no differences between the number of hooks in liver and lung hydatid cysts in each animal species and between sheep , goats and camels . There were no significant differences between rostellar hooks measurements in the examined animal species .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الخلاصـــــة

الخلاصـــــــــة

تم فحص 8123 من الأغنام و 3794 من الماعز و 113 من الأبقار و 739 من الإبل خلال الفترة مابين يوليو 2004 وحتى مايو 2005 ، والتي ذبحت في السلخانة المعتمدة في مدينة سرت . وتبين من الدراسة أن نسبة الإصابة بالأكياس العذاريه (الطور اليرقي للمشوكة الحبيبية) في هذة الحيوانات قد بلغت 4.9 % في الأغنام ، 2.4 % في الماعز و 15 % في الأبقار و 2.7% في الإبل .

أوضحت الدراسة أن الإصابة بالأكياس العذاريه قد سجلت في كلا الجنسين الذكور والإناث لجميع أنواع الحيوانات المفحوصة وتبين من الدراسة أنه لا تأثير لجنس الحيوان على الإصابة في الأغنام والماعز والأبقار ولكن توجد اختلافات معنوية قليلة في الإبل . كما أوضحت الدراسة ان انتشار الإصابة بالأكياس العذاريه يزداد بزيادة العمر . ونتيجة للنمو البطئ للأكياس العذاريه فأن الإصابة لا تكون واضحة في الأعمار الصغيرة من الحيوان .

أظهرت الدراسة عدم وجود فروق معنوية في مدى انتشار الإصابة بالأكياس العذاريه في الأغنام والماعز والإبل المفحوصة على مدار السنة بالنسبة لنوع الحيوان الواحد .

تم تحديد مكان الإصابة بالأكياس العذاريه للحيوانات المفحوصة حيث استأثر الكبد في الأغنام بنسبة 77.9 % بينما الرئتين 48.9 % أما الماعز فإصابة الكبد كانت 72.3 % والرئتين 60 % ونسبة إصابة الكبد في الأبقار 64.7 % وفي الرئتين 58 % ، أما الإبل فالرئتين كانت أكثر إصابة بنسبة 75 % عن تلك في الكبد 50 % . أظهرت الدراسة أنه لا تأثير لجنس الحيوان على مكان الإصابة بالأكياس العذاريه في الأغنام والأبقار والإبل بينما في الماعز تبين وجود اختلافات معنوية بين الجنسين ومكان الإصابة ($P = 0.011$) . كما أظهرت الدراسة أن للعمر تأثير على مكان الإصابة في الأغنام والماعز ($P = 0.000$) ولكن هذا التأثير لم يسجل في الأبقار والإبل .

شدة الإصابة في الأغنام تتراوح بين 1 – 20 كيس في كلا من الكبد والرئتين ، وأظهرت النتائج أن 53.8 % كانت إصابة خفيفة (1 – 3 أكياس) و 36 % إصابة متوسطة (4 – 8 أكياس) و 10.2 % إصابة كثيفة (8 – 20 كيس) . وفي الماعز 61.6 % الإصابة بالأكياس

خفيفة و 28.7 % متوسطة و 9.7 % كثيفة . بينما الأبقار شدة الإصابة تمثلت بنسبة 52.9 % خفيفة و 35.3 % متوسطة و 11.8 % كثيفة . أما الإبل فشدة الإصابة بها 40 % خفيفة و 35 % متوسطة و 25 % كثيفة .

أظهرت النتائج وجود فروق معنوية بين شدة الإصابة والعمر في الأغنام والماعز (P = 0.000) ، ولم توجد هذة الفروق في حالة الأبقار (P = 0.699) والإبل (P = 0.053) . أما جنس الحيوان فلم يكن له تأثير على شدة الإصابة بالأكياس العذاريه .

أكثر الأعضاء إصابة بالأكياس العذاريه في الأغنام هي الكبد ، وأظهر التقصي نسبة كبيرة جدا للأكياس ذات الحجم المتوسط (2 – 5 سم) بنسبة 56.7 % ، بينما الرئتين كانت مصابة بالأكياس صغيرة الحجم (< 2 سم) بنسبة 45.1 % ، نفس أحجام الأكياس سجلت في الماعز بنسبة 45.8 % من الحجم المتوسط (2 – 5 سم) في الكبد وبنسبة 42.8 % في الرئتين من الحجم الصغير ، وأظهرت الدراسة أن معظم الإصابة في الأبقار والإبل كانت بالأكياس ذات الحجم الصغير (< 2 سم) في كل من الكبد والرئتين ، وتبين من النتائج أن الأكياس ذات الحجم الكبير (5 – 10 سم) سجلت فقط في الماعز .

أظهرت الدراسة أن نسبة الخصوبة في الأكياس العذاريه تساوي 72 % في الأغنام و 58% في الماعز و 70 % في الإبل . أما جميع الأكياس العذارية في الأبقار كانت عقيمة . وتبين من الدراسة أنه لا تأثير لعمر الحيوان أو الجنس على خصوبة الأكياس العذاريه في أي نوع من الحيوانات المفحوصة (P > 0.05) .

أشارت الدراسة إلى أن حيوية الأكياس العذاريه في الأغنام والإبل كانت بنسبة 70 % في كلاهما وهي أكثر نسبة من حيوية الأكياس في الماعز (58 %) . تبين من الدراسة أن حيوية الأكياس العذاريه كانت بنسبة 80 % و 76 % في أكباد الأغنام والإبل على التوالي وهي أكثر حيوية من تلك الموجودة في الرئتين 55 % في الأغنام و 62 % في الإبل . بينما حيوية الأكياس العذاريه في الماعز كانت 66 % في الرئتين و 50 % في الكبد . أوضحت الدراسة عدم وجود فروق معنوية بين حيوية الأكياس العذاريه في الكبد والرئتين للحيوانات المفحوصة (P=0.01) وتبين وجود اختلافات معنوية بين حيوية الأكياس العذاريه وحجمها في جميع الحيوانات قيد الدراسة .

أظهرت الدراسة الشكلية (المورفولوجيه) لرؤوس الديدان في الأكياس المائية عدم وجود فروق كبيرة في الحجم في حالة الأغنام والماعز والأبقار ، أما في الإبل تبين أن الرؤوس كانت أكبر حجماً . ومن خلال الدراسة المورفولوجيه للخطاطيف أظهرت عدم وجود اختلاف في العدد في الكبد والرئتين لكل نوع من الحيوانات ، كما تبين عدم وجود أي فروق معنوية بين حجم الخطاطيف ونوع الحيوان .

أوضحت النتائج المتحصل عليها من هذة الدراسة إلى أن الأغنام هي أكثر الحيوانات ، يليها الماعز فالإبل ، ثم الأبقار ورغم أن الأبقار هي الأقل ذبحاً إلا أنها أكثر إصابة وذلك ربما يعزى إلى أنها في أعمار متقدمة وتكون قد تعرضت للإصابة ببيوض الديدان المشوكة الحبيبية أكثر فترة . كما أوضحت الدراسة أن الماعز هي أقل الحيوانات إصابة رغم أنها ترعى مع الأغنام في نفس الأماكن وربما يفسر ذلك باختلاف طريقة التغذية بين النوعين ، حيث أن الماعز تتغذي على الشجيرات والنباتات العالية نسبياً التي غالباً ما تكون ملوثه ببيوض المشوكة الحبيبية أما الحيوانات الأخرى كالأغنام فأنها تتغذي على الحشائش القصيرة حيث كثيراً ما تنتشر بيوض الدودة .

أشار كثير من البحاث إلى أن الإبل تلعب دوراً مهماً في استمرار دورة حياة المشوكة الحبيبية نتيجة لأرتفاع نسبة إصابتها بالأكياس المائية إلا أن أعداد الإبل لا تقارن بأعداد الأغنام التي تساهم في استمرار دورة حياة الطفيل لعدة أسباب منها ، عدد الأغنام الكبير الذي قد يصل إلى أكثر من 8 ملايين ، بينما لا يتجاوز عدد الإبل نصف مليون ، وتذبح الأغنام بأعداد أكبر من الإبل ، كما أن نسبة خصوبة الأكياس المائية في الأغنام أكثر من تلك في الإبل .

النتائج المتحصل عليها في هذة الدراسة تشير إلى أهمية الدراسات التفصيلية للأكياس المائية من حيث شدة الإصابة والخصوبة وتشير الدراسة إلى أن الكبد أكثر إصابة من الرئتين وحيوية الأكياس في الكبد أكثر من تلك في الرئتين ، ولذلك تعتبر الكبد عضو مهم في استمرار دورة حياة الدودة ، وحيث أن الكبد يعتبر هو العضو المفضل لدى المستهلك الليبي ويميل القصابون إلى عدم التضحية بالكبد المصابة بأكملها ويتم فصل الجزء المصاب فقط الذي يتم التخلص منه بطريقة غير سليمة وغالباً ما تلتهمه الكلاب مما يؤدي إلى انتشار الإصابة بالأكياس العذاريه .

تشكل هذة الدراسة أساسا لأي دراسات مستقبلية وخاصة الدراسات المورفولوجيه للدودة البالغة في العوائل الأساسية وأهميتها في أنها قادرة على تحديد أشكال استمرار دورة الحياة فصفات البرقة والدودة البالغة متشابهة بالإضافة إلى الدراسة البيولوجيه الجزيئية وخاصة دراسة الحامض النووي DNA لميتوكوندريا الرويسات المعزولة من الأغنام والأبقار والإبل والإنسان .

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كليـــــة العلـــــوم

قســـم الأحيـــاء

عنـــوان البحـــث

((دراسة انتشار و الشكل الخارجي للطور اليرقي للمشوكة الحبيبية
في الميوانات العاشبة الأليفية في منطقة سرت – ليبيا))

مقدمـــة مـــن الطـــالب

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قســـــــــم علـــــم الحيـــــــــوان

دراسة انتشار والشكل الخارجي للطور اليرقى للمشوكة الحبيبية في الحيوانات العاشبه الأليفة في منطقة سرت – ليبيا

أطروحة مقدمة كجزء من متطلبات الأجازة العليا (الماجستير) في العلوم

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New Implementation of Unsupervised ID3 Algorithm (NIU-ID3)

Using Visual Basic.net

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