An-Najah National University
Faculty of Graduate Studies

Prevalence of Sheep Hydatidosis in North West Bank- Palestine

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Dedication

This work is dedicated to :

Soul of :

Gaza children

Acknowledgement

I would like to acknowledge An-Najah National University for allowing me to get a master degree in public health .

Many thanks go to my theses chairperson Dr. Ayman Hussein , who provided valuables comments and guidance through different stages of this study, with deepest appreciation because without his support , this study could not be achieved .

الإقــرار

أنا الموقع أدناه مقدم الرسالة التي تحمل العنوان:

Prevalence of Sheep Hydatidosis in North West Bank- Palestine

الأكياس المائية في الأغنام في شمال الضفة الغربية– فلسطين دراسة وبائية

اقر بأن ما اشتملت عليه هذه الرسالة إنما هي نتاج جهدي الخاص، باستثناء مــا تمــت الإشارة إليه حيثما ورد، وان هذه الرسالة ككل، أو أي جزء منها لم يقدم من قبل لنيل أية درجة علمية أو بحث علمي أو بحثي لدى أية مؤسسة تعليمية أو بحثية أخرى.

Declaration

The work provided in this thesis, unless otherwise referenced, is the researcher's own work, and has not been submitted elsewhere for any other degree or qualification.

Student's name: **اسم الطالب:**

Signature: **التوقيع:**

Date: **التاريخ:**

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Prevalence of sheep hydatidosis in north West Bank Palestine

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Abstract

Hydatidosis is a zoonotic disease that occurs throughout the world and causes considerable economic losses and public health problems in many countries, it is a major helminthes parasitic infection in West Bank . The current study aims to explore the size of the problem in sheep of West-Bank and answering the question : what is the prevalence of sheep hydatidosis in Palestine ?. A total of 1000 indigenous sheep carcasses were selected from the municipalities abattoirs and slaughterhouses of Nablus, Jenin and Tubas districts . Each animal carcass was inspected carefully, cysts of each organ (liver , lung …) were counted, measured and examined microscopically to determine the fertility .The total prevalence of hydatid cyst was 9 %, distributed according to age of sheep as : 0.6% in hoggets (≤ 1 year), 10 % in 1-2 years, 24% in 2-3 years, 27% in >3 years age . Our research showed that liver was the most infected organ, 51% of cysts infected both liver and lung together (mixed infection), 31% were liver cases alone, while involvement of lung alone was observed in 13 % of the cases .The lower number was in spleen 3% and viscera 1% . Microscopic examination of infected cysts revealed that 17% of organs had fertile cysts . 61% of cysts size were <4 cm and 38 % were >4 cm .

Chapter One

Introduction and literature review

1.1 Background and significance :

Hyadatidosis is a cyclozoonotic infection of cosmopolitan distribution . It is one of the main forms of parasitic disease in farm animals caused by the larval stage of *Echinococcu*s tape worms which utilize canines as definitive host and various herbivores or rodent as intermediate host . Species under genus *Echinococcus* are small tapeworms of carnivores with larval (metacestode) stages known as hydatids proliferating asexually in various mammals including humans. There are five morphologically distinct species in this genus ; *E. granulosus, E. multilocularis, E. oligarthus, E.Vogeli* and *E. shiquicus* (Thompson, 2002) . The adult worm of *E. granulosus* consist of 3 to 4 segments and exhibits two hosts in its life cycle , a carnivore as a definitive host and one species of various domestic herbivorous animals as an intermediate host. Human can be infected with the larval stage if he ingests the eggs of the parasite with either his food or drink (Thompson , 1986) .

E. granulosus eggs are defecated by dung of final hosts and live for some months in humid soil . Mid-hosts (generally sheep, goat and cow) get infected by eating them. Then, membrane of eggs are torn in intestine and spread all around the body especially livers, lungs etc. by means of blood current and gradually grow up there. If these mid-hosts (sheep, goat and cow) or their infected organs are eaten by dog races, mentioned cyst is torn

in duodenum, its embryo fetus are stuck to the walls of narrow intestine and grew adult. Finally with the birth, life cycle of parasite continues. If the mid-host is humankind, life cycle of parasite does not continue because infected organs of human being are usually out of reach of dog races. Humankind cyst infection is caused from mouth due to eating green, food, And drinking water that contains dung of a dog infected to the *E .granulosus* (Eslami, 2005) (figure 1) .

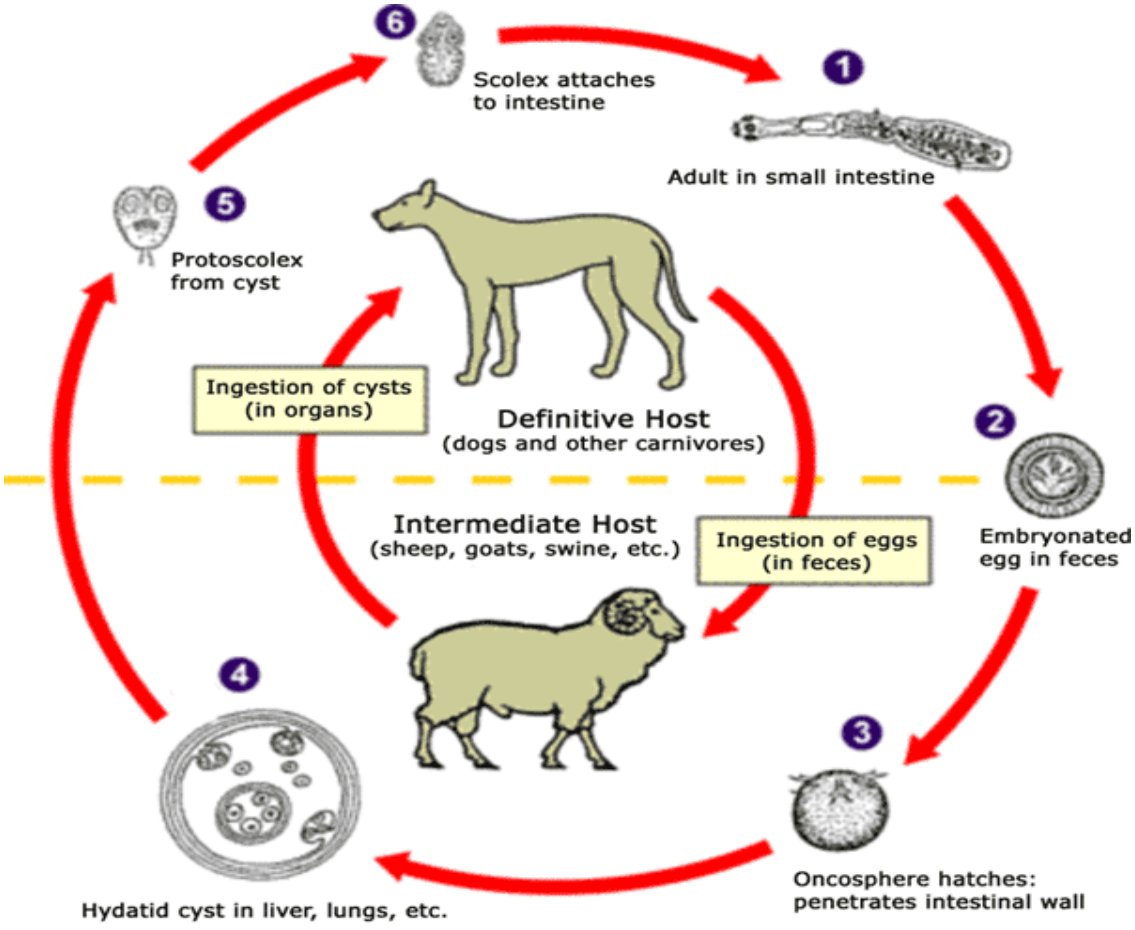

Fig (1) Life cycle of *Echinococcus* species (Thompson, 2002) .

The adult of *Echinococcus* varies between 2 and 11 mm in length and usually possesses from two to seven segments, averaging from three to four segments. The larval stage is a fluid-filled bladder or hydatid cyst that is unilocular, although communicating chambers also occur (WHO, 2001) . Growth is expansive, and endogenous daughter cysts may be produced . Individual cyst may reach up to 30 cm in diameter and occur most frequently in liver and lungs, but may develop in other internal organs . The infection with this stage is referred to as cystic hydatidosis (WHO, 2001) (figure 2) .

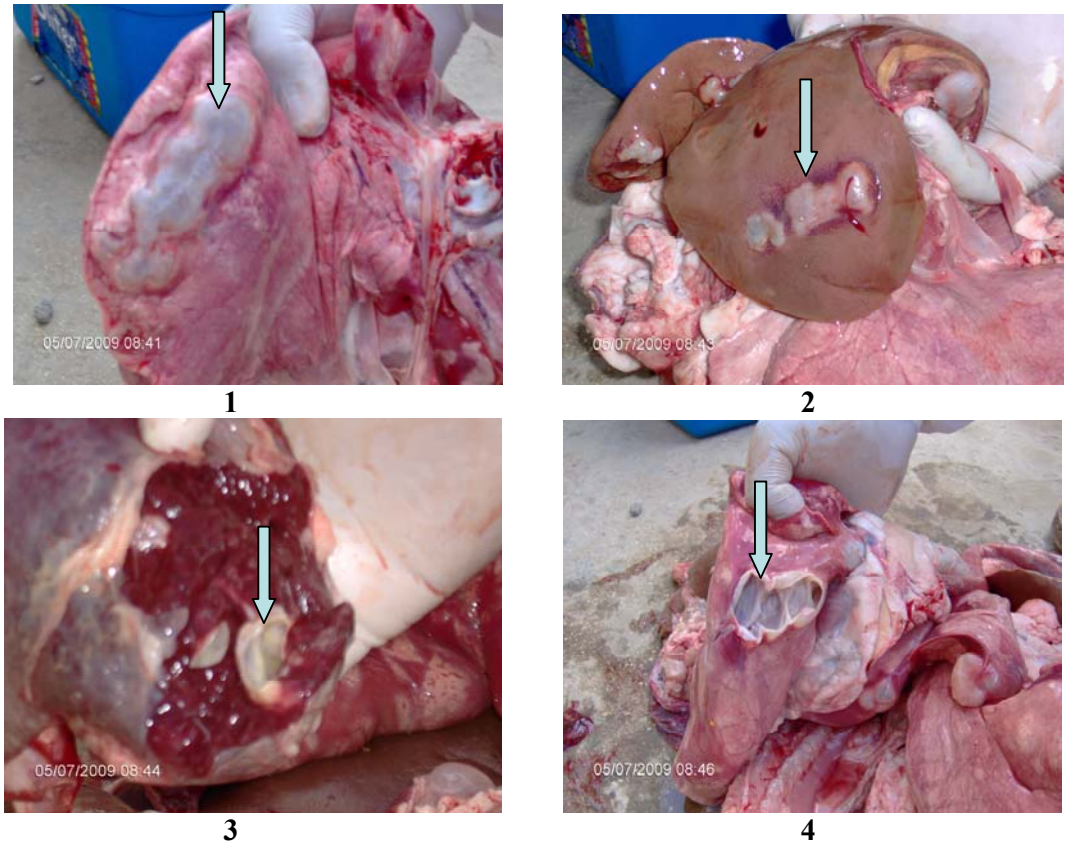

Fig (2) Hydatid cysts in various organs of sheep including : lung (1), Liver (2) and Spleen (3) . Communicating chambers in lung tissue (4) .

Hydatid cyst of *E. granulosus* is unilocular . Its growth is expansive by concentric enlargement . A well developed cyst contains three layers; fibrous capsule of host origin . The middle one is the laminated membrane which is secreted by the thin (germinal) layer and therefore is of parasite origin . The germinal layer gives rise to the broad capsule and daughter cysts (Thompson, 1986) . The cysts are mainly found in the liver (and every possible organ: spleen, kidney, bone, brain, tongue and skin) and asymptomatic until their growing size produces symptoms or accidentally discovered . Cysts are full of fluid and its brood capsules containing protosculex on its inner walls. The fertility of the cysts depends on presence of protoscolices in the fluid, it is one of the important factors in the epidemiology of *E. granulosus* . The fertility of cycts varies depends on the intermediate hosts and geographical situation **(**Farah, 1987).

1.2 Diagnosis of *Echinococcus* :

The diagnosis of *Echinococcosis* in dogs or other carnivores requires the demonstration of the adult cestodes and eggs of *Echinococcus* spp. in their faeces or the small intestine (Nonaka *et al*. , 2008) . While diagnosis in intermediate hosts occurs by necropsy finding . Whereas surveillance for *E. granulosus* in domestic animals may take place in licensed slaughter houses, that for *Echinococcus* sp. in wildlife must be done by field surveys. In livestock intermediate hosts, molecular methods are, however, important

in identification of isolates or strains of *E. granulosus* for epidemiological purposes (Mcmanus & Bryant , 1995) . Serological or immunological tests, useful in humans, are less sensitive and specific in livestock and at present cannot replace necropsy . Antibodies directed against oncosphere, cyst fluid and protoscolex antigens can be detected in the serum of infected sheep, but this approach is presently of limited practical use as it does not distinguish between current and previous infections . Copro antigen tests based on a faecal antigen-detection antibody can be detected shortly after infection (10–14 days) (Craig , 1997) .

DNA recognition methods is currently used mainly for confirmatory testing of coproantigen-positive samples or for identification of taenid eggs recovered from faeces using the different PCR primers from faeces in definitive hosts of genus *Echinococcus* (Mcmanus & Bryant, 1995) .

1.3 Burden of Hydatid cyst disease :

Based on Food and Agricultural Organization (FAO) report, economic damages caused by parasite infections in developed and developing countries are respectively 16% and 30% of their whole livestock production and it is even more in countries where there is no serious prevention policy against parasite infections (WHO, 2001) .

As 75% of world population live in developing countries and they possess 65% of total animals, economic damages are more serious (Taghizadeh and Hoshiar, 2003) .

Echinococcus and its metacestode stage in herbivores and humans have been recognized as the most important helminthes zoonoses, with great economic and public health significances in developing countries (Eckert , 1982) . Cystic *Echinococcosis* causes a huge health problems in animals and economical disadvantages because of production loss . It posses both a human health risk and economic loss to the country, which can takes the form of a reduction in live weight gain, reduced yield of milk, reductions in the fertility rates and reductions in the value of wool or other products . It may also be the most important one . Totally or partially discard of infected organs causes largest costs . Financial loss could be as high as 10% **(** Torgerson *et al*., 2000 **) .** It has a marked social impact because it is also frequently found in the human population (Eckert et al., 2001) .

1.4 Vaccination :

Application of an effective vaccine to reduce hydatid infection in livestock would be likely to have a substantial impact on the rate of transmission of the disease to humans (Lightowlers, 2006) . As *E. granulosus* belongs to the Taeniid family, many aspects of its immunological relationship with its intermediate host are similar to that occurring in *Taenia* species . Moreover, it was considered that the vaccine development approach used in *Taenia* species such as the native host-

protective antigens of *T. ovis* would also be successful for *E. granulosus* (Lightowlers et al., 1996).

Using recombinant DNA technology, an oncosphere antigen vaccine EG95 was shown to be capable of inducing a high level of protection against experimental challenge infection with *E. granulosus* eggs in sheep (Lightowlers et al., 1996).

1.5 Literature review：

The prevalence of hydatid cyst disease either in man or animals has been studied extensively . In this study we are concentrated on *E. granulosus* in sheep . *E. granulosus* has a global distribution; *E. multilocularis* occurs in wide areas of the Northern Hemisphere, *E. shiquicus* is found in the People's Republic of China and *E. oligarthrus* and *E. vogeli* are confined to Central and South America (WHO, 2001).

All five species are infective to humans causing various forms of echinococcosis . Human cystic echinococcosis, caused by *E. granulosus* and alveolar echinococcosis, caused by *E. multilocularis*, are the most important public health threats in many parts of the world (WHO, 2001) . There are about 3 million patients who are infected in the world (Craig *et al*., 1996) . Latency can be up to 50 years, and mostly found in South and Central America , the Middle East , China, and the West of the U.S.A. (Craig *et al*., 1996). Hydatid cyst disease has world-wide distribution which

found in various countries including : Mediterranean region, South America, Africa, the Middle East, Russia, Central Asia, China and Europe (Bart *et al*., 2006 Fasihi *et al*., 2002 , Rosenzvit *et al*., 1999 , Zhang *et al*., 2000) (figure 3) .

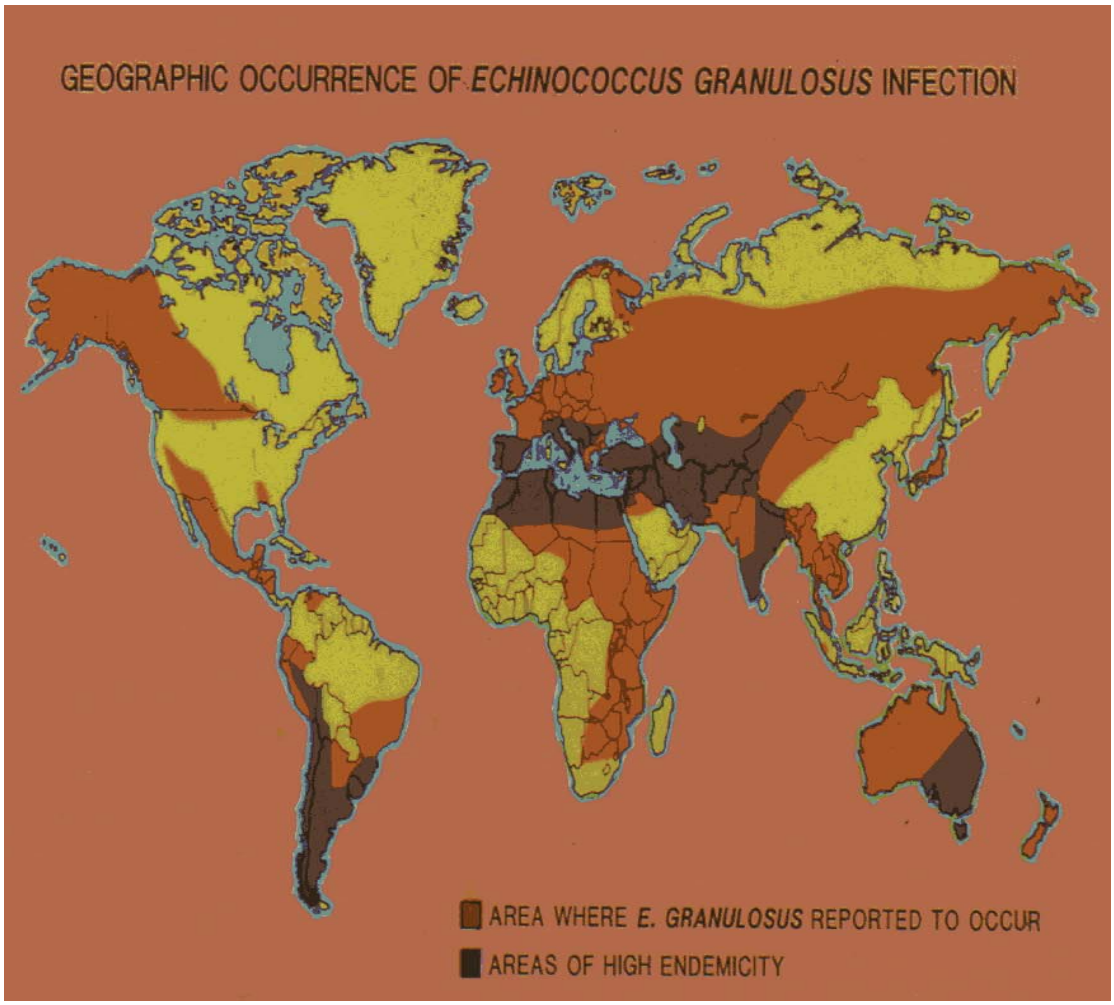

Fig (3) Global distribution of *Echinococcus granulosus* .

The prevalence of hydatid cyst in sheep in Greece, China, İtaly, Ethiopia, India, Azerbaijan and Pakistan have been reported to be 100% (Hi-monas *et al*., 1994) ; 88.6% (Andersen *et al*., 1993) ; 91.3 % (Bortoletti *et al*., 1990) ; 17.2 % (Bekele *et al*., 1988) ; 7.05% (Hafeez *et al*., 1994) ; 63-67

% (Chobanov *et al*., 1991) ; 3.04 % (Anwar *et al*., 1993) , respectively . In Iran many studies have been performed ; in Sanandaj area, western Iran and Kashan area, results indicated an infection rate of ; 51.9% (LAkhlagh *et al* ., 2005) ; 11.1% (Dalimi *et al* ., 2002) and 2.7% (Arbabi and Hooshyar 2005) respectively . Another study on sheep which has been carried out in Turkey and showed an infection rate of 3.50% (Meltem *et al* . , 2007) .

Sheep, goats, cattle, camels, buffaloes, pigs and donkeys have been repeatedly found infected with hydatid cysts in Iraq, Jordan, Lebanon, Syria, Kuwait and Saudi Arabia (Molan, 1993 ; Al-yaman, 1985 ; Abdel-Hafez, 1986 ; Abo-Shehada, 1993 ; Dajani, 1978 ; Hassounah, 1976 ; Ghandour, 1988) . The prevalence of Hydatid disease in sheep from Saudi Arabia, Kuwait, Jordan, Morocco, Syria, Sudan, and Iraq have been reported to be 4.6% (Farah, 1984), 12.8% (Hassonah and Behbehani , 1976), 4% (Al-Yaman *et al*. , 1985), 5.3% (Pandey *et al*., 1988) 4.5% (Dajani, 1978), 6.9 % (Elmahdi *et al*. , 2001), 5.9 %, 4.5 % (Al-Abbassy *et al.* , 1980 and Molan, 1993), respectively .

Azlaf and Dakkak studied the prevalence of cystic echinococcosis in Morocco in 2004, after the post mortem inspection concerned 2948 sheep in five different regions, the global CE infection prevalence rates obtained was 10.58% (Azlaf and Dakkak , 2004) .

Examination of 471 sheep, slaughtered in abattoirs in North Jordan was carried out during March–May 1984 and showed an overall infection rate

of 27.8% **(**Abdel-Hafez *et al* .,1986) . Another study in the same country in 1992 using indigenous sheep from five regions of Jordan showed an infection rate of 12.9% , The higher prevalence was (27.6%) which observed in sheep from Karak (Kamhawi *et al* ., 1992) .

Five thousand and Five hundred and ninety-six head of sheep (443 local, 473 Romanian and 4680 Australian) slaughtered in Amman Central Abattoir during November -December 1999 were examined in routine meat inspection procedures for hydatid cyst . 20.3% of the local sheep were infected .While 12.8% of Australian sheep were infected, **(** Anwar, 1999) .

In Egypt Hydatidosis was investigated among sheep in Egyptian official abattoirs, from August 2000 to August 2005. The overall five years hydatidosis prevalence was 0.3% . (Haridy *et al* ., 2005) .

A study in Hadhramout (Yemen) on 218 sheep carcasses were examined in (2005/2006) . The prevalence was 3.21% (Baswaid , 2007) . In Libya astudy in an Shahat abattoir in Al-Jabal showed an infection rate of (8.7%), of 554 sheep, 48 sheep were infected (Al-Khalidi , 1998) .

The relationship between age and infection with *E. granulosus* was investigated in many studies . In Thrace (Turkey), The cysts were found in 2.64% of 720 lambs (<1 year old) and in 31.8% of 22 sheep (between 1-6 years old) (Meltem *et al* ., 2007) . In North Jordan the rate of hydatid infection increased with age and reached as high as 63.7 percent in ewes 4 years of age and older **(**Abdel-Hafez *et al* .,1986) . Abo-Shehada in 1993

studied the relation between age and infection . He found that infection in sheep age less than two years was 0.4 %, 2-4 years : 46.3 %, 5-6 years : 78.8 % and 7-8 years : 84.8 % (Abo-Shehada, 1993) . The same result was recorded by Baswaid in Yemen : Below 1 year was 0% ; 1-2 years : 2.3% ; 2-3 years : 12% ; over 3 years : 17% .

Location of cysts has been also investigated . The liver was the predilection site of infection .These findings were reported from studies in Saudi Arabia (Farah, 1984), Yemen (Baswaid, 2007), Jordan (Al-Yaman *et al* 1985), (Abdel-Hafez *et al* .,1986), (Kamhawi et al ., 1992) and (Abo-Shehada, 1993) . The liver was also the predominant site of infection in other studies. In Turkey, cysts were encountered in the liver of 96.2%, in the lungs of 26.9%, and in the spleen of 3.85% . Out of infected sheep 23.1% had fertile cysts (Meltem *et al* ., 2007) . In North Jordan 71.1 % of liver and lung and 7.6 % of spleen had cysts (Abdel-Hafez *et al* ., 1986) . While in Yemen the liver was the predominant site of infection 29% but liver and lung 71% (Baswaid , 2007) .

In Libya Liver infection was 87% while lungs infection 33.4 % and Spleen 4.2% (Al-Khalidi ,1998) . But lungs are the most predominant organs in Pandey study in Morocco (Pandey *et al ,* 1988) .

Firtility of cysts was reported in many studies to be : in Yemen (46.8%) (Baswaid , 2007), Iraq (39.4%) (Al-Abbassy, 1980), Kuwait (88.2%) (Hassonah and Behbehani ,1976) . In Jordan, the percentages of sheep, with

fertile cysts were reported in the range of 7.1– 68.7, (Al-Yaman *et al*, 1985) , (Abdel-Hafez *et al* .,1986), (Kamhawi *et al* ., 1992) , (Abo-Shehada, 1993), (Dajani and Khalaf, 1981) .

History of hudatidosis In Palestine :

In human :

History of the endemic nature of hydatidosis in palestine was reported in 1933 by Witenberg and in 1947 by Torance . These authors noted a high incidence of cysts in slaughtered animals and the common occurrence of human patients in Jerusalem, Jaffa, and other cities in the area (Matossian et. al, 1977) . Rakover indicated that Israel has had a high morbidity rate of about 100 cases per annum of human hydatidosis (5 per 100 000 population). This, however, has been ascribed, in part, to the immigration of infected patients (Matossian et. al, 1977) .

The clinical, surgical, and diagnostic problems of hyddatidosis have been described by Levy and Peller *et al*. (Levy, 1970 ; Peller *et al.,* 1973) .

In 2002 Abu-Hassan *et al* studied human cystic echinococcosis in West-Bank by investigating the surgical incidence in hospitals between 1990 to 1997. A total of 390 surgically confirmed cases were recorded throughout the 8-year period, with an overall mean annual surgical incidence (MASI) of 3.1 per 100,000. A high MASI of 4.9, 5.0 and 5.1 per 100,000 was found in Hebron, Jericho and Bethlehem Governorates, respectively. Yata town,

Hebron governorate, showed the highest MASI, at 16.8 per 100,000 (Abu-Hasan *et al*. , 2002) .

According to Palestinian Ministry of health Reports ; table 1 summarizes the number of human cases of *Echinococcus* disease from 1999 to 2008 in Palestine (MOH, 2008) .

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In animals :

In 1977 its prevalence has varied from 0.02% in Tel-Aviv to 12% in Beersheba (Matossian et. al, 1977) .

A survey carried out in 1991-1992 in the town of Yirka in Northern Israel on sheep slaughtered in the local abattoir during a one-month period revealed *E. chinococcus* cysts in 10% of the sheep (Furth *et al*. ,1992) .

In the same contents there is no official records in Palestine regarding the prevalence of hydatid cyst disease in animals either in the Palestinian ministry of agriculture or the veterinary services or municipality abattoirs (MOA, 2008) .

Table (1) : Human *Echinococcus* according to MOH in Palestine from 1999 till 2 / 2009 (MOA, 2008) .

Year	Number of cases
1999	6
2000	4
2001	4
2002	4
2003	13
2004	10
2005	15
2006	9
2007	27
2008	17
till 2\2009	9

1.6 Aims of the study :

Echinococcosis is an important disease but it is a neglected public health problem in the Arab area, especially in rural communities . In Palestine , hydatidosis may be one of the major infectious zoonotic diseases becuase most abattoirs in Palestine are closed or not well qualified , where sheep , cattle and goats are still slaughtered traditionally and carcass wastes are easily accessible to scavenging dogs and other wild carnivores, which are roaming freely and in large groups every where, due to absence of poisoning and shooting controlling programs for killing stray dogs by veterinary services . This study is therefore undertaken to determine the extent of spread of animal hydatidosis among slaughtered animals . It is clear that hydatidosis is considered a major public health problem in Palestine . From my experience as a director of many veterinary service departments in Tubas , Nablus and Qalqylia , I have noticed that

many animals are infected with hydatid cyst disease . Since the animals share the same life cycle as man , therefore determination of the prevalence of the disease in West Bank is very important in order to explore the size of the problem which helps to control the disease . This work is the first epidemiologically analyses of sheep hydatidosis in Palestine which aims to alert policy makers to design governmental control programs against hydatidosis and to minimize prevalence in Palestine either in human or in animals .

Chapter Two

Materials and Methods

2.1 Design of the study :

A cross-sectional study was carried out in order to investigate the prevalence of hydatid cyst disease in sheep in North of the West-Bank . Indigenous sheep which were slaughtered at local abattoirs were selected for the current study .

2.2 Study area:

Three districts in North of West-Bank were selected for this study . These districts are Nablus, Jenin and Tubas (Figure 4) . These governorates are considered one of the most sheep raising areas in Palestine . The population of the area is approximately 400, 000 inhabitants, most of them (60%) are living in rural areas and are involved in animal production (PCBS , 2007) . The number of animals in these areas is nearly about 300,000 heads of sheep; 120,000 in Nablus , 130,000 in Jenin and 50,000 in Tubas (PCBS , 2007) . Sheep are one of the most principal slaughtered animals for human consumption on social and religious occasions . Slaughtering in Nablus district occurs in the main abattoir . However, Tubas and Jenin still lack abattoirs and the process takes place in streets , traditional slaughter houses, and markets . The dogs in these areas which are the final host of the parasite carrying hydatid cyst disease either live with herds of sheep or look after the houses or farms. Meanwhile, the stray dogs roam also freely and live on food garbage's

particularly in mountainous area . They may enter into the human house and farm in search for food . These carnivores may consume infected organs of slaughtered animals which are sometimes left behind around the non-standard abattoirs in cities, villages and camps.

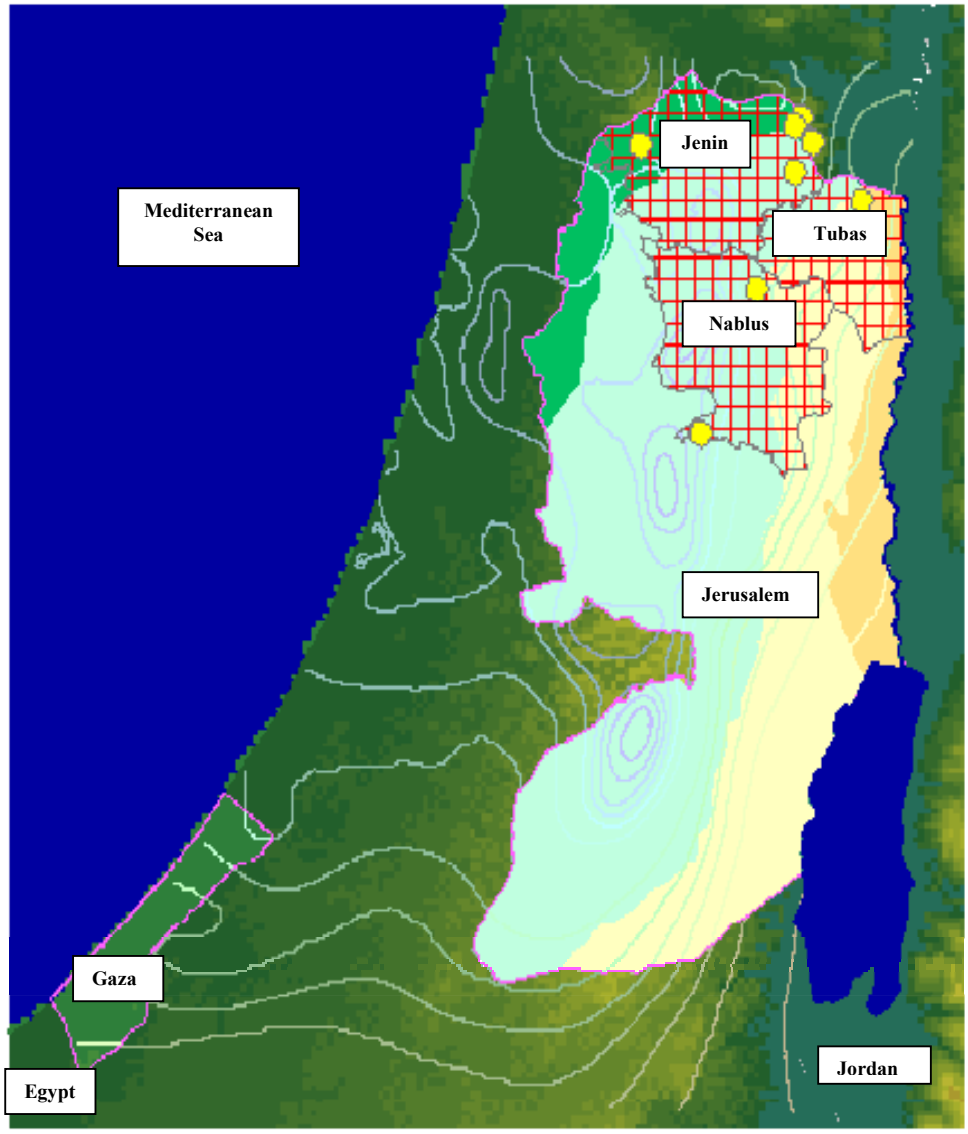
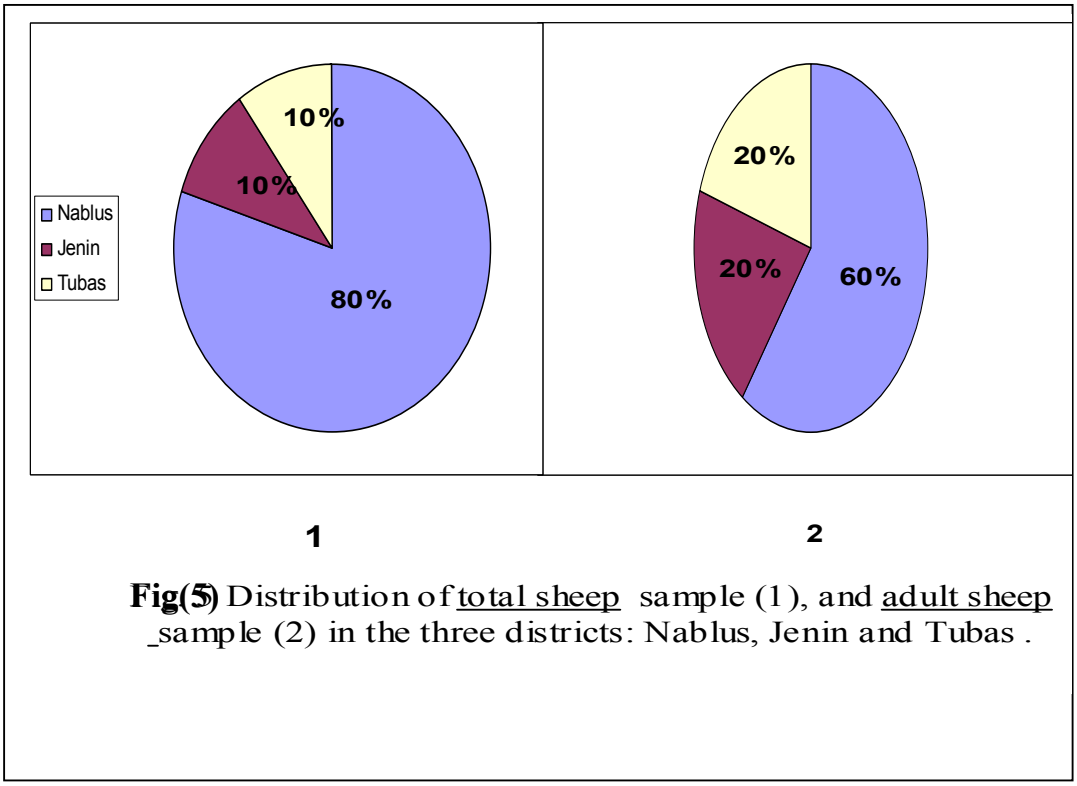


Fig (4) The regional setting of West Bank and location of the cities :Nablus, Jenin and Tubas .

2.3 Sample size :

The sample size used in the current study was 1000 indigenous sheep (local breed) . 500 of them were chosen to be hogget's (less than one year) and the rest were adult . The distrubution of sheep selected in this study is described in figure 5 .



Fig(5) Distribution of total sheep sample (1), and adult sheep _sample (2) in the three districts: Nablus, Jenin and Tubas .

2.4 Examination of slaughtered animals :

Sheep collected from the three districts were examined for the presence of hydatid cysts . In parallel, the following data were recorded : serial number, date, age, infection, organ, number of cysts, nature and size of cyst .The carcasses included in this study were inspected

carefully by visual examination . The presence of cysts in various organs were examined by naked eye and palpation carefully . Cysts of infected organs were counted and their size were measured by special caliper. Incisors of animals teeth are inspected to determine the age of the animal . Infected organs were transported to the laboratory at An-Najah National University and further analysis to determine the state of the cysts was performed . The fertility of cysts were examined microscopically .

Each cyst was cut-opened with scissor where the content of the cyst was mixed . A drop of cyst fluid was examined to the presence of protoscolices . The cyst which contained no protoscolices as well as suppurative, calcified, or degenerated were considered as unfertile cyst .

Whenever and wherever the cysts were present, they were removed and incised . The shrunk, evacuated, pus formatted cysts classified as degenerated cysts, while the solid and sands contained one considered as calcified cysts, while the fluid filled one and had no protoscolices by direct microscopic examination considered as sterile cyst (figure 6) .

2.5 Data analysis :

Results of the study were analyzed using statistical package of social sciences (SPSS) . Variables were considered using Chi – Square test and T-Test . Confidence interval of the differences and significance were assumed by cross tabulation of different groups of variances .

(1)

(2)

(3)

(4)

Fig (6) 1. Examination of slaughtered animals . 2. Counting of cysts .

3. Transporting infected organs to the laboratory .

4. Examining the contents of the cyst .

Chapter Three

Results

3.1 General characteristics :

A total of 1000 sheep of various ages were selected for this study . The presence of hydatid cysts in various organs was investigated . Figure 7 shows the age distribution of sheep . 500 of sheep were selected to be hogget (age of sheep equal to one year or less) and were originated from Nablus area, 14 % of sheep were of one to two years age , followed by 12.6 % were of two to three years old, and 23.4 % were more than 3 years old .

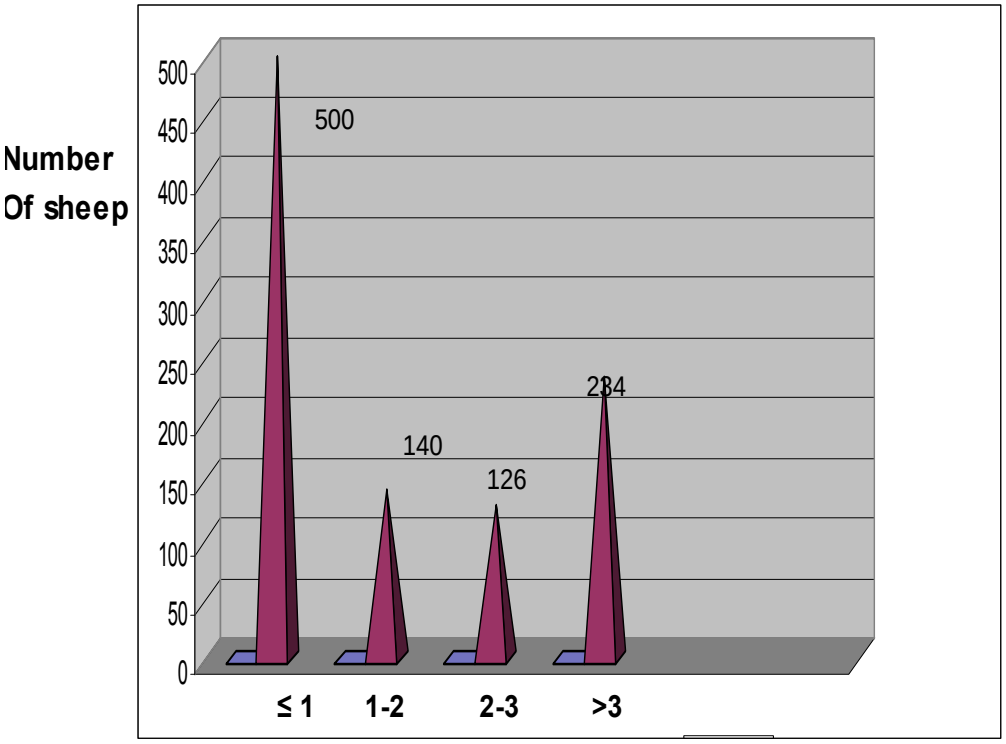


Fig (7) Distribution of sheep according to age .

The result showed that 9.1 % of sheep have hydatid cyst, a total of 91 case were found to be infected with larval parasite . Table 2 summarizes the number of infected animals with hydatidosis in adult sheep (Sheep >1year) in various districts . The highest rate of infection was Tubas district (22%), although rates of infection in those three areas are relatively similar, Nablus district had the lowest rate where 47 (15.6 %) of sheep have been infected followed by Jenin districts which showed 19 positive cases from 100 sheep .

Table (2) : Prevalence of hydatidosis in adult sheep (>1year) in various areas of northern West-Bank **.**

District	No. Examinated Animals	infected animals	
		Number	(%)
Nablus	300	47	16 %
Jenin	100	19	19 %
Tubas	100	22	22 %

The results of the study showed that the prevalence of hydatidosis were significantly lower in hoggets (sheep of age equal to one year or less) .

compared to adult sheep ($p < .000$) . It was found that of 500 carcasses

equal to one year or less, only three animals were infected (an infection rate of 0.6%) . Of 500 carcasses of adult sheep of various ages (more than one year), 88 sheep were infected (an infection rate of 17.6%) .

Figure 8 reveals The presence of hydatid cyst in various age-group of Sheep . Chi-square test showed significant variation in the prevalence of infection in different age groups (P< .000) .The highest infected cases observed in age group of more than three years old, of 184 animals, 50 were infected (an infection rate of 27.2%), followed by sheep aged two to three years old, of 101 animals, 25 were infected (an infection rate of 24.7%), then the last group of sheep from one to two years , of 127 animals 13 were infected (an infection rate of 10.2%) .

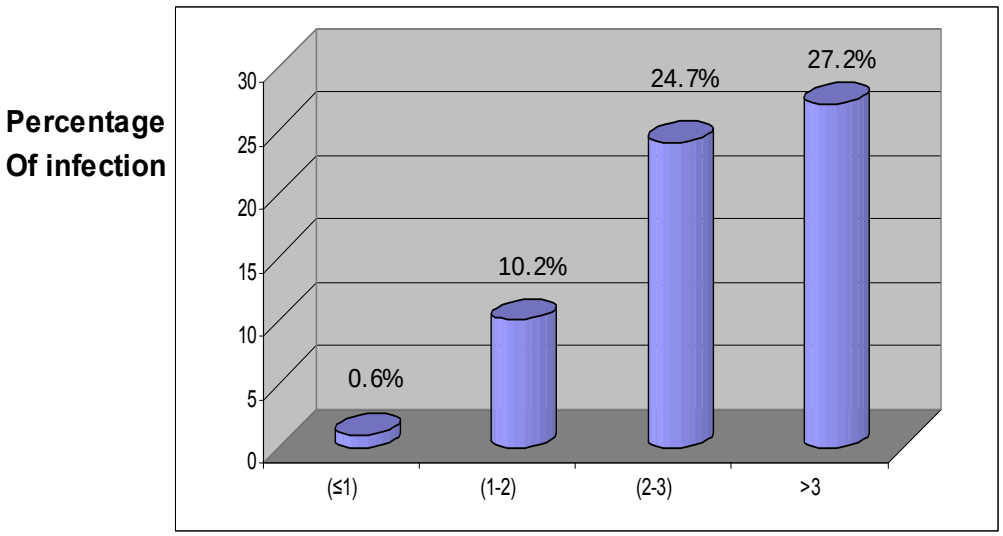


Fig. 8 : percentage of hydatid cyst in various age-group of sheep

3.2 Cyst location :

The location of cysts over various tissues has been examined . Our research showed that liver was the most infected organ with hydatidosis where 75 cases (83 %) were found infected, lung was the second organ where 58 cases (64%) . Spleen had the lowest number 3 % . Table 3 summarizes the distribution of hydatid cyst in organs of studied sheep, 46 (51%) of cysts from both liver and lung together (mixed infection), 29 (31.8%) were only liver cases .

The involvement of lung alone was observed in 12 (13.1%) of the cases . The lower number was in spleen which recorded with liver and lung together (mixed infection) in only three cases (3%) and viscera in one case (1%) only . The analysis of cyst location in 91 hydatid cyst cases showed significant variations between organs ($p<.000$) .

Table (3) Distribution of hydatid cyst in organs of studied sheep .

Infected organs	Frequency	Percentage
Liver +Lung (mixed)	46	51%
Liver only	29	32%
Lung only	12	13%
Spleen	3	3 %
Viscera	1	1%
Total	91	100%

3.3 Age and location of cyst :

Figure 9 reveals the distribution of infected organs per age group . It shows that the age group one year old or less had only liver infection, while the group aged 1-2 years had only liver or lung infection . Both liver and lung

infections were found only in 2 to 3 years old sheep and in sheep of more than 3-years group . It is worth to mention that infection of both liver and lung is found mostly in sheep of >3 years old . Spleen infection was reported only in more than 3- years old sheep group .

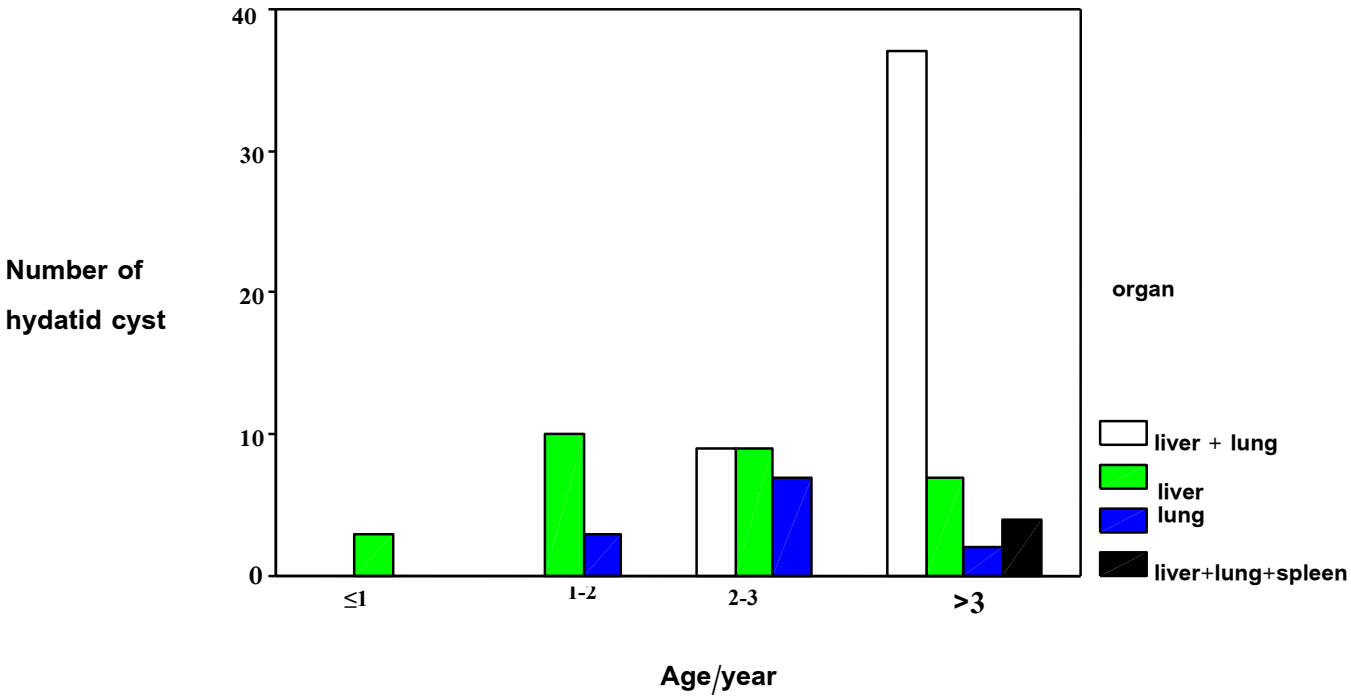


Fig (9) : Distribution of infected organs in sheep of various ages .

3.4 Number and size of cysts :

Distribution of single and multiple cysts in total organs is listed in Table 4 . Multiple cyst have been found in 75 (82%) of total cases, while single cyst have been found in 16 (18%) of cases . Of multiple cysts 58 cases (63%) had >3 cysts, 10 cases (11%) had three cysts and 7 cases (7.6%) had 2 cysts .

Table(4) : Frequency and percentage of hydatid cyst forms recovered from different organs .

Number of cysts	Frequency	%
1	16	18%
2	7	7.6%
3	10	11%
>3	58	63%
Total	91	100%

Figure 10 illustrates the size of hydated cyst in infected sheep . 56 (61%) of cysts were <4 cm and 35(38%) of total cysts were >4 cm .

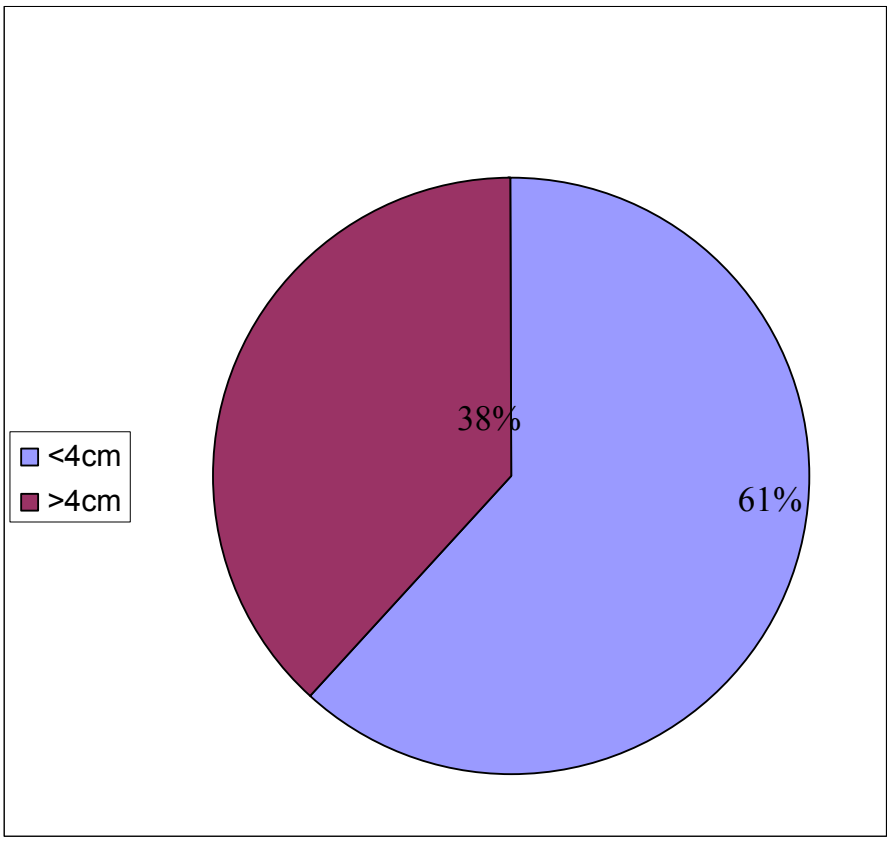
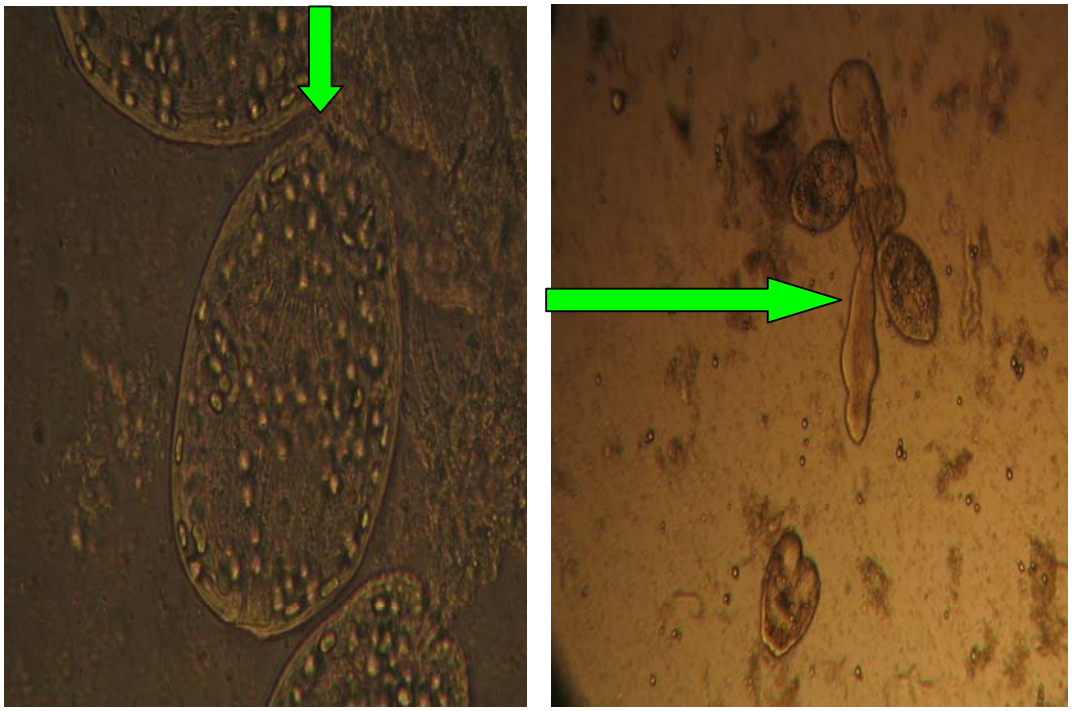


Fig. (10) : size of cysts (cm) in infected sheep .

3.5 Nature of cysts :

Microscopic examination of infected cysts revealed that (17%) of organs had fertile cysts and (83%) had sterile cysts . Figure 11 shows protoscolices (psc) which were removed from cyst obtained from infected organ .



(1) (2)

Fig (11) : Echinococcus granulosus Protoscolices from fertile cysts in infected sheep showing normal (psc) and evaginated (psc) .

Table 5 summarizes the nature of hydatid cysts isolated from sheep infected organs . only 17% of isolated cysts were fertile while the rest were infertile .

Table (5) : Nature, number and percentage of cysts of infected organs .

Nature of cysts	Number	percent
Sterile, degenerative and calcified	30	33%
Sterile and degenerative	8	9%
Sterile and calcified	15	%16
Sterile	19	21%
Calcified	4	4%
Fertile	15	17%
Total	91	100%

3.6 Age of sheep and number of cysts ;

Table 6 summarizes the relationship between age group and the number of cysts . The data analysis showed that there is a significant associations between sheep age and total number of cysts ($p < .000$) . Results reveals that the highest number of more than 3 cyst was found in age group of >3 years old it was (40) (68%) of cysts . While it was only 5 cysts (8%) in the age group ≤ 2 years old . There is direct correlation between age of sheep and number of cysts .

Table (6) : The relationship between age group and the number of cysts in sheep .

Age	Number of cysts			
	1	**2**	**3**	**>3**
≤1	2	1		
1-2	6		2	5
2-3	4	3	5	13
>3	4	3	3	40
Total	16	7	10	58

3.7 Age of sheep and size of cysts ;

Figure 12 reveals the relationship between age of sheep and size of cysts .The cross tabulation between age and size reflicts the direct correlation between them . Size increases significantly with advanced age ($P< .000$) . The highest percent of cysts more than 4 cm was recorded in sheep aged more than three years . It has been shown in 32% of total cysts, while cysts less than 4 cm have been shown in 23% of cysts of sheep of the same age group . In sheep aged two to three years , cysts less than 4 cm was similar to the previous group(22%) . And only 6% of cysts were more than 4 cm . Cysts of sheep of one to two years age were only less than 4 cm . They have been recorded in 15 % of total cysts . No cysts were measured more than 4 cm in these ages .

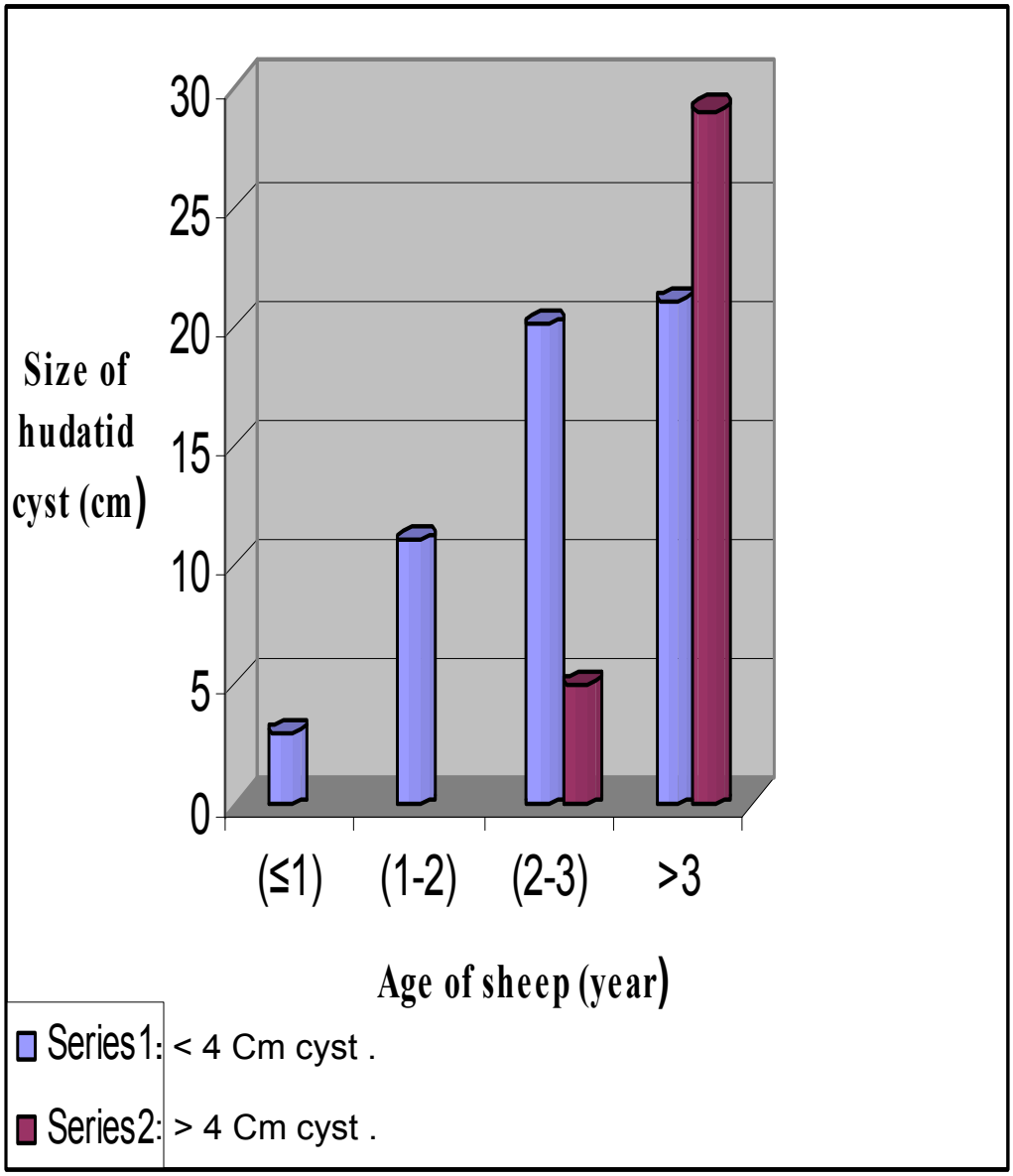


Fig (12) : The relationship between age groups of sheep and size of hydatid cysts .

Chapter Four

Discussion

In North West Bank, where the largest open area of Palestine, particularly Tubas and Jenin destricts, there are large population of stray dogs and other wild carnivorous live near human houses, interaction between domestic cycle and wild cycles may occur . In this regard, animals may become infected by consuming infected organs of slaughtered animals left around the non-standard small abattoirs and slaughtered houses in villages. Among the present study which showed that cystic echinococcosis is spreading among sheep, in addition to its presence in human beings in West Bank 3.1 per 100,000 (Abu-Hasan *et al*., 2002) . Our study has revealed that 9.1 % of sheep have hydatid cyst . The results are similar to other reports in Israil from where the rate of infection in sheep of age less than one year was 0.02% (Matossian et. al, 1977) . , More over, the rate of infection in sheep of older age in other studies in Israel are similar where Lass *et al* study showed 12% in Beersheba .Our study showed also a similar rate of infection in Northern Israel 10% (Furth *et al*., 1993) . It worth mentioning that area under study either in our study (North W.B.) or Furth *et al* study (North Israil) are under same area .

In comparison to other regions, it is clear that the prevalence of hydatidosis in our study has higher rate . For example, the prevalence in the current study is about 2-fold of prevalence reported from : Saudi Arabia : 4.6% (Farah, 1984), Yemen : 3.21% (Baswaid , 2007) , Jordan : 4% (Al-

Yaman *et al*., 1985), Morocco : 5.3% (Pandey *et al*., 1988), Iraq : 5.9%, 4.5% (Al-Abbassy *et al*., 1980 and Molan, 1993), Syria ; 4.5% (Dajani, 1978), Sudan : 6.9 % (Elmahdi *et al*., 2001), Egypt : 0.3% (Haridy *et al*., 2005), Libya : 8.7% (Al-Khalidi ., 1998), Kashan region of Iran : 2.7% (Arbabi and Hooshyar 2005) and Turkey : 3.50% (Meltem *et al*., 1998) .

It is however, similar to the results of other studies : 12.8% in Kuwait (Hassonah and Behbehani ,1976), 27.8 in North Jordan (Abdel-Hafez *et al*., 1986), 12.9% in five regions of Jordan (Kamhawi S *et al*.,1992), 20.3% in Amman Central Abattoir (Anwar , 1999) , 10.58% in Morocco (Azlaf , Dakkak , 2004), 51.9% in Sanandaj area in Iran ((LAkhlagh *et al*., 2005) and 11.1% in western Iran (Dalimi *et al*., 2002) .This difference is attributed, perhaps to the variability of the following : origin of animals, mode of grazing , presence of definitive host (carnivore), degree of contamination with parasite and other environmental factors as periodical destruction of dogs, improved standards of meat inspection, overall improvement in socio economic conditions, hygienic status of sheep herds, variations in the temperature, environmental conditions, the nature of the pasture and the way of raising of these animals .

The age of the animals is another factor in these variations . In our survey, the majority of slaughtered animals were bred out doors, and there was a strong practical relationship between animal offal and scavenging dogs .

The highest rate of infection was in Tubas district . The reason behind it could be of geographic reason, , out door breeding with open grazing areas, more carnivorous Population (sheep dogs), no central abattoirs and there is no hygienic elimination of sheep's offal with more environmental parasite contamination . In Jenin district the situation is similar to Tubas, but more awareness about anti helmentic drugs . Nablus district had the lowest rate, this may be attributed to elevation nature of the district, central official hygienic slaughtering, more knowledge about anthelmentic dosage, and indoor breeding .

The liver in my study was the most infected organ . These findings were similar to the observations reported in Saudi Arabia (Farah, 1984), Yemen (Baswaid , 2007), Jordan (Al-Yaman *et al*., 1985),(Abdel -Hafez *et al*., 1986), (Kamhawi *et al*.,1992) and (Abo-Shehada, 1993), but did not coincide with those of Pandey *et al*., In Morocco (Pandey *et al*., 1988), where lungs are the most predominant organs . The liver was the most common site of infection in sheep .The lungs came in the second place in the present study . This is mainly due to the fact that the liver is the first organ the blood flows through after leaving the intestine . Therefore, most of the oncospheres hatched in the intestine are filtered in it . The ones that are not trapped in the liver are passed to the lungs then other organs (Al-Khalidi, 1998)

In our study the older animals were highly infected, more number of cysts, bigger size of cysts, and more infected organs, while the younger ones had low rate of infection, less number of cysts, smaller size of cysts, and less infected organs . This is attributed to various factors . Firstly, higher age reflects a much longer period of risk of infection . Secondly, the chances of detecting cysts at meat inspection are higher in aged animals due to the bigger size of the cyst . Finally, the older animal cysts have more time to enlarge and transport cysts to other organs . In our survey only three sheep less than one year of age were found positive . Echinococcus egg, in general, requires at least one year before the hydatid cyst stage grows sufficiently to produce protoscolices capable of infecting the carnivore host (Smyth, 1964) . These three positive cases may be due to wrong dentation . The fertility of cyst is an important factor that can effect stability of *E. granulosus* cycle depending on geographical situation, kind of infected host site and size of cyst . Fertility was 17% in my study, which is substantially lower compared to what has been observed in Yemen (46.8%) (Baswaid , 2007), Iraq (39.4%) (Al-Abbassy, 1980), Kuwait (88.2%) (Hassonah and Behbehani ,1976), Jordan (38.1%) (Kamhawi *et al*., 1995) but higher compared to that observed in Jordan (8.0%) (Al-Yaman *et al*., 1985) . In Jordan, the percentages of sheep, with fertile cysts were reported in the range of 7.1– 68.7%, (Al-Yaman *et al*.,1985), (Abdel-Hafez *et al*., 1986),

(Kamhawi *et al*., 1992) , (Abo-Shehada, 1993), (Dajani and Khalaf, 1981)

The low rate of fertile cysts and small size of cysts in our study is contributed to the high contamination and parasitic infestation in sheep and over use and multi use of antiparasitic and anthelmantic derivatives such as Ivermectine, Albendazole, Febendasole and others for long period before slaughtering to increase sheep weight .

Limitations :

1. Lack of official abattoirs in the study area especially in Tubas and Jenin districts, which makes the researcher to looks for traditional slaughter houses in different villages and locations.
2. Time of slaughtering occurred at dawn, this makes it difficult for the scholar to carry out inspection procedure in proper time.
3. Difficulty in dealing with butchers without reward, because he feels shameful at slaughtering adult sheep, that affects his reputation .
4. Difficulty in transporting infected organs to the laboratory on time for recognizing the nature of cyst.
5. Difficulty in determining the age of animal by dentations .
6. Difficulty in diagnosis of cysts in sheep less than one year due to its small size .
7. Lack of adult sheep (more than one year) specially in Tubas and Jenin, and if there it slaughtered in mysterious way .
8. Lack of scientific periodicals references, books and magazines related to parasitology in palestine .

Recommindation :

* Scope of my thesis is to alert policy makers to design governmental control programs against hydatidosis to minimize prevalence in Palestine, and ensure effective protection not only for animal population but also for humans at risk of contracting the infection .
* New checks and controls are hoped for at a political level which will increase the financial support for the farmers and encourage importing and testing of vaccines which have already been tested in other areas in the world .
* Killing rambling dogs and preparing identity card and collar for them .
* Treatment of animals with anti-parasite medicines (specially sheep and dogs) and prophylactic anthelmentic dosage four times yearly for all animal farms .
* Preventing illegal slaughtering and making healthy slaughter houses (not to allow rambling dogs enter to the field of slaughterhouses) .
* Public health learning through TV, and teaching livestock holders and people who are at risk about periodic epidemiologic investigations .

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Appendix

SPSS of the results .

Group Statistics

	infection	N	Mean	Std. Deviation	Std. Error Mean
age	pos	91	3.3407	.84616	.08870
	neg	909	1.9692	1.21170	.04019

Independent Samples Test

		Levene's Test for uality of Varianc		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	ig. (2-taile	Mean Difference	Std. Erro Difference	Lower	Upper
age	Equal variances a	28.224	.000	10.541	998	.000	1.37146	.13011	1.11614	1.62679
	Equal variances n assumed			14.083	130.200	.000	1.37146	.09738	1.17881	1.56412

Group Statistics

	infection	N	Mean	Std. Deviation	Std. Error Mean
organ	pos	91	1.7143	.86005	.09016
	neg	909	5.0000	.00000	.00000

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
organ	Equal variances assun	2251.938	.000	-115.705	998	.000	-3.28571	.02840	-3.34144	-3.22999
	Equal variances not assumed			-36.444	90.000	.000	-3.28571	.09016	-3.46483	-3.10660

Group Statistics

	infection	N	Mean	Std. Deviation	Std. Error Mean
number	pos	91	3.2088	1.17867	.12356
	neg	909	5.0000	.00000	.00000

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
number	Equal variances assu	2586.572	.000	-46.026	998	.000	-1.79121	.03892	-1.86758	-1.71484
	Equal variances not assumed			-14.497	90.000	.000	-1.79121	.12356	-2.03668	-1.54574

Group Statistics

	infection	N	Mean	Std. Deviation	Std. Error Mean
nature	pos	91	1.8022	1.64127	.17205
	neg	909	1.0000	.00000	.00000

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
nature	Equal variances assu	997.680	.000	14.803	998	.000	.80220	.05419	.69585	.90854
	Equal variances not assumed			4.663	90.000	.000	.80220	.17205	.46039	1.14401

Group Statistics

	infection	N	Mean	Std. Deviation	Std. Error Mean
size	pos	90	2.3667	.50725	.05347
	neg	908	1.0000	.00000	.00000

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
size	Equal variances assu	8148.496	.000	81.559	996	.000	1.36667	.01676	1.33378	1.39955
	Equal variances not assumed			25.560	89.000	.000	1.36667	.05347	1.26043	1.47291

Crosstabs

age * infection Crosstabulation

Count

		infection		
		pos	neg	Total
age	<1	3	497	500
	1-2	13	127	140
	2-3	25	101	126
	>3	50	184	234
Total		91	909	1000

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	103.824[a]	3	.000
Likelihood Ratio	118.129	3	.000
Linear-by-Linear Association	100.074	1	.000
N of Valid Cases	1000		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 11.47.

Crosstabs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
age * organ	1000	100.0%	0	.0%	1000	100.0%

age * organ Crosstabulation

Count

		organ					
		liver + lung	liver	lung	liver+lung +spleen	Not Infected	Total
age	<1		3			497	500
	1-2		10	3		127	140
	2-3	9	9	7		101	126
	>3	37	7	2	4	184	234
Total		46	29	12	4	909	1000

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	170.529[a]	12	.000
Likelihood Ratio	169.304	12	.000
Linear-by-Linear Association	103.996	1	.000
N of Valid Cases	1000		

a. 9 cells (45.0%) have expected count less than 5. The minimum expected count is .50.

Crosstabs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
age * number	1000	100.0%	0	.0%	1000	100.0%

age * number Crosstabulation

Count

		number					
		1	2	3	>3	Not Infected	Total
age	<1	2	1			497	500
	1-2	6		2	5	127	140
	2-3	4	3	5	13	101	126
	>3	4	3	3	40	184	234
Total		16	7	10	58	909	1000

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	133.852[a]	12	.000
Likelihood Ratio	143.640	12	.000
Linear-by-Linear Association	44.135	1	.000
N of Valid Cases	1000		

a. 10 cells (50.0%) have expected count less than 5. The minimum expected count is .88.

Crosstabs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
age * size	998	99.8%	2	.2%	1000	100.0%

age * size Crosstabulation

Count

		size			
		Not Infected	<4	>4	Total
age	<1	496	3		499
	1-2	128	11		139
	2-3	101	20	5	126
	>3	184	21	29	234
Total		909	55	34	998

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	139.681[a]	6	.000
Likelihood Ratio	143.479	6	.000
Linear-by-Linear Association	109.711	1	.000
N of Valid Cases	998		

a. 2 cells (16.7%) have expected count less than 5. The minimum expected count is 4.29.

جامعة النجاح الوطنية
كلية الدراسات العليا

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دراسة وبائية

إعداد
جهاد حمد الإبراهيم

إشراف
الدكتور أيمن حسين

قدمت هذه الأطروحة استكمالاً لمتطلبات درجة الماجستير في الصحة العامة بكلية الدراسات العليا في جامعة النجاح الوطنية في نابلس، فلسطين .
2009

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الملخص

الأكياس المائية مرض مشترك بين الإنسان والحيوان ينتشر في العالم مسببا خسائر إقتصادية وخسائر في الصحة العامة في العديد من البلدان ، وهو مرض ديداني طفيلي منتشر في الضفة الغربية . هذه الدراسة تهدف الى استكشاف حجم المشكلة في أغنام الضفة الغربية والإجابة على السؤال : كم هي وبائية المرض في فلسطين . تم اختيار ألف ذبيحة من الأغنام المحلية من مسالخ ومجازر محافظات نابلس، جنين وطوباس . كل جثة تم فحصها بعناية، ثم تم فحص الأكياس في الاعضاء المصابة (كبد، رئة .....) وإحصائها وقياسها واختبارها بالمجهرلتحديد خصوبتها . وبائية المرض في فلسطين كانت 9.1% وهي موزعة حسب العمر كما يلي : 0.6% في المواليد أقل أو تساوي سنة، 10 % في الأعمار 1-2 سنة، 24% في الأعمار 2-3 سنة، 27% في الأعمار > 3 سنوات . أظهرت الدراسة أن الكبدأكثر الأعضاء إصابة، 51% من الأكياس أصابت الرئة والكبد في نفس الوقت (إصابة مختلطة)، 31% أصابت الكبد منفردا، بينما التي إصابت الرئة وحدها كان 13% من الحالات، أقل إصابة كانت في الطحال 3% والأحشاء 1% . الفحص المجهري أظهر أن 17% من الحالات تحوي أكياسا مخصبة . 61% من الأكياس كان حجمها اقل من 4 سم و 38% أكبر من 4 سم .