بسم الله الرحمن الرحيم

Public Health Awareness about Echinococcosis/Hydatidosis Among Professionals and the General Public in Urban and Rural Communities

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DEDICATION

This work is dedicated

To

The Soul of my Father and Mother

Kind Husband... Mohammed,

Lovely son...Ahmmed,

My Brothers,

My Sisters,

And

To all whom I love.

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In the name of Allah, Most Gracious, Most Merciful Praise be to God. The Lord and Cherisher Of the Worlds Who protect me and guide me to complete this work and that was one of Allah's Graces on me because He Whom Allah guides is rightly guided; but he whom He misleads, you will find no protector to lead him to the right way.

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ABSTRACT

This study was conducted to assess the level of knowledge of physicians, veterinarians and paramedical staff about zoonoses and Echinococcosis. In addition, it evaluated the level of awareness of urban and rural communities about zoonoses, Echinococcosis and health hazards from animals. Data were collected through a questionnaires and meat inspection in slaughter slab in Tambool area, as an example of rural slaughter facilities. The questionnaire also involved groups of specialists in medical fields, rural and urban communities, as follows: 300 physicians, 250 veterinarians, 200 medical assistants, 50 environmental and health workers. In addition to 100 animal owners and 100 housewife were included to represent the community. The questionnaires included questions related to zoonotic diseases, the Hydatid disease and health hazard from animals. The questionnaires were filled by the participants and analyzed using simple statistical methods of frequency and percentage. The information analysis and meat inspection of slaughtered animals in Tambool area revealed the following: (1) 40 camels out of 201 (19.9%) harbored Hydatid cyst. The cysts were found in camels' lungs; (2) 20 out of 195 sheep/goat, (10.2%) harbored cysticercus tenuicollis; (3) Inadequate knowledge about zoonoses and Echinococcosis revealed in all mentioned groups except the veterinarians requires more information to let the targeted groups achieve best health goals and (4) Misdiagnosis of Hydatid cysts was assumed, which requires more training for meat inspectors. The study was concluded by designing an extension programs depending on requirements and limitations that were revealed in the questionnaire information analysis, and these programs can be broadcasted through TV after testing and improvement.

المستخلص

الهدف الرئيسي من هذه الدراسة هو تقدير مستوي المعرفة للمختصين في الحقل الطبي من أطباء وأطباء بيطريين وكوادر طبية مساعدة عن الأمراض المشتركة بين الإنسان والحيوان ومدي المعرفة بمرض الأكياس العدارية. بالإضافة إلي تقييم مستوي وعي المجتمع بالأمراض المشتركة بين الإنسان والحيوان ومرض الأكياس العدارية والمخاطر الصحية المتعلقة بالحيوان. جمعت معلومات هذه الدراسة بواسطة الاستبيان وفحص اللحوم في مسلخ منطقة تمبول كمثال لفحص وسلامة اللحوم في الريف. شملت الدراسة إشراك المجموعات المستهدفة من المختصين والمجتمع الريفي والحضري في الاستبيان كما يلي: 300 طبيب و250 طبيب بيطري و200 كادر طبي مساعد و50 عامل صحة وبيئة بالإضافة إلي تمثيل المجتمع المستهدف باستبيان 100 مالك حيوان و100 ربة منزل.

اشتملت الاستبيانات على أسئلة متعلقة بالأمراض المشتركة ومرض الأكياس العدارية ومخاطر العلاقة بالحيوان وكانت طريقة التحليل المستخدمة هي طريقة التكرار والنسبة المئوية.

أتضح من التحليل الإحصائي للاستبيان وفحص اللحوم للحيوانات المذبوحة في مسلخ تمبول كما يلي:

1. أربعون عينة موجبة للأكياس العدارية (19.9%) من مجموع 201 من الإبل وجدت الأكياس في أنسجة الرئة في كل الإبل المذبحة.
2. عشرون عينة موجبة لحويصلات الدودة الشريطية *Cysticercus tenuicollis* (20.2%) في الماعز والضأن من مجموع 195.
3. نقص المعرفة بالأمراض المشتركة ومرض الأكياس العدارية في كل الفئات المذكورة ما عدا الأطباء البيطريين مما يستوجب مزيد من المعلومات لكي توصل إلي المجموعات المستهدفة لتحقيق أهداف الصحة العامة.
4. وجود أخطاء في تشخيص الأكياس العدارية، مما يتطلب العناية بتدريب العاملين في فحص اللحوم.

خلصت الدراسة إلي تصميم برامج إرشادية اعتماداً على الاحتياجات والقصور الذي ظهر في تحليل المعلومات من الاستبيان وهذه الرسائل يمكن أن تبث عبر التلفاز بعد أن تختبر وتحسن.

INTRODUCTION

Veterinary public health is an integral part of the general public health and includes various types of cooperation between the disciplines that link the health triad, people-animals-environment. With all of its interaction it plays a vital role in the safety of human life. It is considered one of the most important branches of science to increase the awareness of the community at different levels, and create enough knowledge about the hazards associated with zoonotic diseases. The role of veterinary public health in the developed countries has shifted towards food safety and quality, while in the developing countries it aims at control of zoonotic diseases. Human health is linked to animal health and production. This link between human communities and animal population, and with the surrounding environment, is particularly close in developing regions where animals provide substantial work power in transportation, draught power, fuel as well as high quality proteins (meat, eggs and milk). In both developing and industrialized countries, however, this can lead to a serious risk to public health with severe economic consequences. A number of communicable diseases between man and animal (known as zoonoses) are transmitted from animals to humans. Communities must be aware of the zoonoses and public health because community participation is essential for the success of public health programmes. Veterinarians and physicians are considered the sponsors of public health and should work together with the environmental workers and health workers to achieve the public health safety standards.

Nowadays most of the serious communicable diseases that have affected humans over several years have been caused by pathogens

that originated from animals or products of animal origin. Many of these man diseases are associated with the improper handling of diseased domestic and wild animals in their natural habitat or farms to markets and slaughter slabs and slaughter houses/slabs.

Over 200 zoonoses have been described and they are known since many centuries. They involve all type of agents: bacteria, parasites, viruses and unconventional agents.

One of these important diseases is Echinococcosis/ Hydatidosis or Hydatid disease, referring to infection with a cestode worm infectious to dogs with intermediate larval stage naturally transmitted to man, domestic and wild herbivorous animals. It thus claims membership of the most significant group of communicable diseases.

The clinical and economic significance of the parasite is almost completely confined to infection with the metacestodes {Hydatid cyst}.The causative agent*; Echinococcus granulosus* is one of 4 species of genus *Echinococcus* which is a zoonotic pathogen. It has a wide host range {sheep, goat, camel, cattle and man}.The significance of the disease comes from the wide host range, the adult worm is assumed not to be highly pathogenic, and thousands may be present in a dog without clinical signs. In domestic animals the hydatid in the liver or lungs is usually tolerated without any clinical signs, and the majority of infections are only revealed at abattoir. In Sudan, the incidence of Echinococcosis has probably increased in recent years as a result of increased ownership of dogs, erroreous handling of diseased animals, negligance of treatment or proper care of owned animals, presence of innumerable stray dogs in close contact with people in markets and around the slaughter houses without any control of expanding populations, and inadequate practice of safe slaughter.

Slaughter practices in Sudan are often responsible for the presence of the hydatid disease because of:

1. Improper disposal of infected offal in slaughter houses after meat inspection.
2. Slaughter at house levels in different occasions like: "Eid Aladdha", “Karama" and in different celebrations. In these slaughtering practices, allowing dogs to eat the discarded parts of offal, suggest an on-going cycle of dog-intermediate host-dog. This put humans at high risk because of the close association of dogs with domesticated animals and humans. The hydatidosis is influenced by the habits and the style of living of people in various communities, for example, when human population share environments with infected dogs, the probability that any given individual will become infected depends, in part, upon factors such as personal hygiene (dirty hands disease). Socioeconomic and cultural characteristics are among the best defined risk factors for human infection such as:
   - Uncontrolled dogs living close with people.
   - Uncontrolled slaughter of livestock.
   - Ill sanitary living conditions.
   - Direct contact with infected dogs, particularly the playful and intimate contact characteristic of children and their pets, would seem to be the most important source of human infection.

Cestode eggs adhere to hairs around the infected dog’s anus and may also be found on their muzzle and paws. Indirect means of contact, via water and contaminated vegetables, or through the intermediary of flies and other arthropods, may also result in human

infections. Thus this study was planned to study gaps in knowledge about this disease in elite and other communities.

Objectives:

This study aims at:

1. Assessment of the level of the knowledge and the awareness of the specialists particularly: physicians, veterinarians and health workers about zoonoses and the gaps in their knowledge about Echinococcosis.
2. Evaluation of awareness level of the animal owners and various consumers communities about health hazards from animals contact and meat.
3. Estimate prevalence of cysts in slaughtered animals in open slaughter slab in a rural slaughter slab in Tumbool area.
4. Suggest a design for awareness raising protocol through mass media to help in control of this disease.

CHAPTER ONE

LITERATURE REVIEW

1.1 Zoonosis

Echinococcois is a zoonosis of great medical, veterinary and economic importance and cause public health problems. It has a global distribution and is insidiously spreading into countries previously free of it (Matossian *et al*., 1977). Veterinary Public Health (VPH) was defined by the World Health Organization (WHO) consultation on future trends in veterinary public health as "the sum of all contributions to the physical, mental and social well-being of humans through an under-standing and application of veterinary science" (Anon, 1999). The zoonoses, any disease and/or infection which is naturally "transmissible from vertebrate animals to man" is classified as a zoonosis according to the Pan American Health Organization (PAHO) publication "Zoonoses and communicable diseases common to man and animals". Over 200 zoonoses have been described and they are known for centuries. They involve all types of agents: bacteria, parasites, viruses and unconventional agents (Anon, 2005). Also Zoonoses were defined as "A zoonosis is any disease or infection that is naturally transmissible from vertebrate animals to humans. Animals thus play an essential role in maintaining zoonotic infections in nature. As well as being a public health problem, many of the major zoonotic diseases prevent the efficient production of food of animal origin and create obstacles to international trade in animal products" (Anon, 2009).

Accurate information about the epidemiology and surveillance of zoonotic diseases is essential for designing, implementing and

evaluating control, prevention or eradication programmes. Abattoirs offer an opportunity to obtain reliable data on a number of important animal diseases, including the major zoonoses. For example, it should be possible to trace cases of infected meat back to the production unit, using an animal identification system. (WHO, 2002).Of the re-emerging zoonosis Echinococcosis/Hydatidosis stand high on the list.

1.2 Classification of Echinococcus

Phylum : *Platy helminthes*
Class : *Cestoda*
Subclass: *Eucestoda*
Order : *Cyclophyllidae*
Family : *Taeniidae*
Genus : *Echinococcus* (Thompson *et al,* 1995)

Species of the genus of *Echinococcus* are small (2-8 mm) cestodes of carnivores (especially dogs).The larval stage, or hydatid cyst, occurs in animals and man causing hydatid disease, also known as hydatidosis or Echinococcosis. Although there are four species generally recognized *(E.granuolsus, E. multilocularis*, *E. oligarthrus* and *E. vogeli*), only the first one is the chief agents of hydatid disease throughout the world. *E. vogeli* gives rise to a polycystic form of the disease in Columbia and *E. oligarthrus* has not yet been identified as the cause of human disease (WHO, 1981).

1.3 Basic life cycle

The biological cycle of this parasite is closed between canides (mainly dogs) as final hosts and mammals (sheep, goat, cattle, horse, pig, camel and human) as intermediate hosts. The definitive host becomes infected by ingesting protoscolexes which are produced by a sexual multiplication of the metacestodes. There may be several

thousands protoscolexes within a single cyst, and each one is capable of developing into a sexually mature adult worm. An adult worm produces eggs, each containing a single embryo (oncosphere), which are voided in the faeces of the definitive host. The eggs, which are capable of surviving in the environment for varying periods, are infective to numerous species of herbivorous upon ingestion.

The prepatent period in the final host is around 40-50 days, after which only one gravid segment is shed by the tapeworm per week. The oncospheres are capable of prolonged survival outside the host, being viable on the ground for about two years. After ingestion by the intermediate host, the oncosphere penetrates the gut wall and travels in the blood to the liver, or in the lymph to the lungs, these are the two common sites for larval development, but occasionally oncospher escape into the general systemic circulation and develop in other organs and tissues (Urquhart, 1987).

Growth of the hydatid is slow, maturity being reached in 6-12 months. In the liver and lung; the cyst may have a diameter of up to 20 cm .In rare sites such as the abdominal cavity where unrestricted growth is possible, it may be very large, and contain several liters of fluids. The cysts in the human have enormous sizes from 1-10 cm and sometime reach about 16 cm. Growth rates of the cysts is highly variable from 1-5mm/year, 6-15 mm/year and 31mm/year. (Romig, 1990)

1.4 Epidemiology

In the pastoral cycle the dog is always involved, being infected by the feeding of ruminant offal containing hydatid cyst. The domestic intermediate host will vary according to Local husbandry but the most

important is the sheep which appears to be the natural intermediate host.

The pastoral cycle is the primary source of hydatidosis in man, the infection being by accidental ingestion of oncosphere from the coats of dogs, or from vegetables and other foodstuffs contaminated by dog faeces (Urquhart *et al.,* 1987).

When human population share environments with infected dogs, the probability that any given individual will become infected depends, in part, upon factors such as personal hygiene (dirty hands disease). Socioeconomic and cultural characteristics are among the best-defined risk factors for human infection:

- Uncontrolled dogs living closely with people.
- Uncontrolled slaughter of livestock
- Low sanitary living conditions
- Direct contact with infected dogs, particularly the playful and antimate contact characteristic of children and their pets, would seem to be the most important source of human infection. Cestode eggs adhere to hairs around the infected dog's anus and may also be found on their muzzle and paws. Indirect means of contact, via water and contaminated vegetables, or through the intermediary of flies and other arthropods, may also result in human infections (Rausch, 1974).

1.5 Transmission dynamics

Hydatidosis has been reported to occur in many species of livestock in Northern African countries with variable rates of infection, but it occurs regularly in highest levels in areas where high prevalence of *E. granulosus* has been reported in dogs. It appears that

camels are important maintenance hosts in all Northern African countries, and sheep, goats, and cattle play a secondary role in the propagation and maintenance of *E. granulosus* (Ibrahem, 1997).

Many factors, including human behavior, host, environmental contamination, livestock management, and slaughtering practices, influence the prevalence of hydatidosis in livestock in different areas. Home slaughtering of animals (without meat inspection) and the feeding of hydatid infected organs to dogs, and other socio-cultural factors (such as the festival of Eid El-kabeer) during which millions of animals may be slaughtered in a single day, help to maintain a highly infected dog population (Ibrahem, 1997). Long-standing cultural and religious habits account for the high and unusual incidence of Hydatidosis among the members of the Turkana tribe of northwest Kenya, which has attracted the attention of researchers. A large number of dogs live with this pastoral tribe, and the dogs have a high rate of infection: dog feces are used as a lubricant and medication. In addition, dead persons are either not buried or are covered with only a thin layer of earth, thereby permitting them to be devoured by dogs and jackals. MacPherson *et al*., (1983) thought that man may serve as an intermediate host in the transmission cycle of *E. granulosus* in the Turkana district, which would make the situation unique in the world.

The heterogeneity of susceptibility of dog to infection with *E. granulosus* affects the number of worms that establish in different hosts. In arid areas such as northwest Kenya, Australia, and North Africa, worm burdens of 20-30000 had been reported (MacPherson *et al*., 1985; Gemmel *et al*., 1986). The number of eggs produced by each worm segment varies between 100 and 1500 (Wachira *et al*., 1991). The high worm burdens found in dogs in Libya (Gusbi *et al*.,

1990) and the high prevalence of *E. granulosus* reflects the relative ease of access of dogs to infected offal and the resulting high egg output. This output is attenuated by short survival time of the eggs on grassland and ground due to the hot, dry environment (Wachira *et al*., 1991).

1.6 Host specificity and susceptibility

The definitive host of *Echinococcus* is always a carnivore and the degree of host specificity expressed is far greater than at the intermediate host level. For example, apart from a strain which utilizes the lion (MacPherson, 1986), felids appear to be refractory to infection with *E. granulosus*. Extensive laboratory and field studies in different parts of the world have demonstrated that the domestic cat play no role as a definitive host for *E. granulosus* (Thompson, 1977). In Australia, the red fox (Vulpes vulpes) is an important definitive host for the sheep strain of *E. granulosus*, acquiring infection by scavenging, and is an increasing public health problem with the incursion of infected foxes into urban areas (Thompson, 1991). *E. multilocularis* has the fox as its major definitive host and may also utilize the domestic dog and cat. However, *E. multilocularis* develops poorly in cats compared with dogs (Thompson and Eckert, 1983). Of four species of *Echinococcus*, only *E. oligarthrus* does not appear to mature in dogs and characteristically uses wild felids as definitive hosts.

The factors responsible for such differences in host specificity are not completely understood. The micro topography of the small intestine (e.g. crypt and villous size) between species of definitive host may be more suited to certain species or strains of *Echinococcus* than

others (Smyth and Smyth, 1968). Such physical factors may play an important role in the initial establishment of the parasite but do not explain why in certain hosts, such as *E. granulosus* in cats, the parasite may initially establish but fail to complete its development. In this respect, it has been proposed that difference in the composition of bile between definitive hosts species may influence host specificity (reviewed by Smyth, 1968, 1969). Apart from bile there is likely to be many biochemical and nutritive factors, as well as physiochemical and immunological characteristics that could play an important role in specificity. Such factors may also influence susceptibility (Thompson, 1991).

1.7 Pathogenesis and clinical signs

The adult worm is not highly pathogenic, and thousands may be present in a dog without clinical signs. In domestic animals the hydatid cyst in the liver or lungs is usually tolerated without any apparent clinical signs, and the majority of infections are only revealed at the abattoir. Where oncospheres have been carried in the circulation to other sites such as: kidney, pancreas, CNS, or marrow cavity of long bones, pressure by the growing cyst may cause a variety of clinical signs. In contrast, when man is involved as an intermediate host the hydatid cyst in the pulmonary or hepatic site is often of pathogenic significance. One or both lungs may be affected causing respiratory symptoms, and if several hydatid cysts are present in the liver there may be gross-abdominal distension. If a cyst should rupture there is a risk of death from anaphylaxis or if a person survives, released daughter cysts may resume development in other regions of the body (Urquhart *et al,* 1987).

Since cysts can be localized in any anatomical site the symptoms depends primarily on:

- The involved organs
- Size of lesions and their sites
- Interaction between the cyst and adjacent organ structures, particularly by the bile ducts and the vascular system of the liver (Thompson *et al.,* 1995).

1.8 The disease in human

Man is an accidental host of *E. granulosus* who contact the infection by direct contact with infected dogs, or indirectly through contaminated food, water and objects. Direct contact is important, the gravid proglottids of *Echinococcus* are found primarily on the surface of faecal matter, and they can accumulate in the perianal region, where they disintegrate and release the eggs. The dog carries the eggs on its tongue and snout to different parts of its body, and person's hands can become contaminated by touching the animal. Close contact with dogs and deficient personal hygiene practices are important factors in the transmission of the infection from dogs to humans. Another source of infection to humans can be vegetables and water contaminated with the parasite's eggs. Coprophagic flies may serve as mechanical vectors of the infection.

In the human host, metacestode cysts may develop virtually in all anatomic sites, but liver and lungs are the most frequently affected organs, (Eckert *et al*., 2000). The initial phase of the infection is always asymptomatic. Small well encapsulated or calcified cyst typically does not induce major pathology and may remain asymptomatic for years or perminently (Pawlowski, 1997). After a highly variable incubation period of months or years, the infection

may become symptomatic, particularly if the cysts are growing, causing a variety of tumor like symptoms related to the number and size of the cysts and the organ site. Rupture of the cysts presents the greatest danger for the patient and is often fatal (Pawlowski, 1997), owing to the anaphylactic shock and pulmonary edema caused by rapid absorption of the released antigen. Another serious consequence of cyst rupture is hydatid cyst seeding within the abdominal or pleural cavity, and the formation of many new cysts. Rupture of a cyst can also cause arterial embolisms in the lungs and sometimes in other organs.

Due to the internal location of cysts, direct parasitological diagnosis is not possible. Biopsy is inadvisable due to the possibility of anaphylaxis or secondary hydatidosis, and so, in most cases diagnosis is made directly using imaging techniques (X Rays, Bronchoscope, Computerized Axial Tomography (CAT), Magnetic Resonance Imaging (MRI), and Ultra Sound (US)) or indirectly using serology. Serology is useful in the diagnosis of hydatid disease in humans, especially if used with imaging techniques such as Ultrasound (Schantz and Gottestein, 1986).

Unfortunately, surgery is the treatment of choice at present, but several of the benzimedazole compounds have been shown to have efficacy against the hydatid cysts in humans. Long-term treatment with albendazole has a particularly marked effect on the cyst (Mc Manus and Smyth, 1986).

1.9 Disease in Sudan

A preliminary report of hydatid disease on some of the intermediate hosts (sheep, goat and cattle) and the definitive host (the dog) in the Sudan was done by Eisa *et al*., (1962). They reported that

the infection rate with hydatid disease in cattle, sheep and goats examined in Equatoria and Upper Nile provinces was 25%, 19.3% and 33.3% respectively. They also made a survey regarding the prevalence of the adult worms in dogs. They reported 86.5% prevalence in Kapoeta district and 26.6% in Torit district. They also reported 115 human cases infected with hydatid disease from amongst the Latuka tribe in Torit and Kapoeta in 1960/61.

Hydatidosis of domestic animals in the Central region of the Sudan was surveyed by El Badawi *et al*. (1979). They reported that the incidence of hydatidosis in slaughtered animals was 35% in camels followed by 8% in sheep, 4% in cattles and 3% in goats.

Saad and Magzoub (1989a) studied the role of sheep and goats in the epidemiology of the disease. They claimed that the role of goats might be excluded from the cycle, since the prevalence in goats was low (4.4%) and the cysts encountered were either calcified or under calcification.

In another study conducted by Saad and Magzoub, (1989b), out of 1169 cattle and 119 camels examined, 45 (3.84%) and 93 (48.69%) were found to harbor hydatid cysts. Fertility rates of cysts were found to be high in camels (42.4%) and (29%) in cattle. The lung was found to be a favorite site for cysts in camels. The liver was found to be a preferred site for cysts in cattle.

Experimental work on hydatidosis in the Sudan was first conducted by Slepneve *et al*. (1977), who infected four puppies with cysts from cattle and camels. They reported that the time required by scoleces derived from camel's hydatid cysts to develop to maturity was 48-52 days (average 50 days); while for those obtained from cattle hydatid cysts the period was 46-50 days (average 48 days).

Experimental transmission of hydatid infection from camels and cattle to dogs was carried out by Saad and Magzoub (1988). They reported that the recovery rate of adult worms in dogs ranged from 20.9-71.6% with worms of cattle origin, and with those of camel origin it ranged from 0.7-81.5%.

The average period required by scoleces to develop to maturity was 43 and 45 days for scoleces derived from cattle and camel origin respectively.

They concluded that, their findings indicate the importance of cattle and camel as intermediate hosts responsible for maintaining the cycle of the parasite in the Sudan, and also confirm the importance of the role played by camels as the major intermediate hosts of Echinococcosis in the country.

The survival of protoscoleces from camel origin was investigated by Saad and Zein El Abdin (1983), they found that 83.5% of the protoscoleces were alive after 5 daysof storage at 4^{o}C.

1.9.1 Animal hydatidosis in Sudan

Studies on Echinococcosis of animals in Sudan were carried out by Abdel Malek (1959), Eisa *et al.* (1962), Slepneve *et al.* (1976), among dogs at Soba, and El Khawad *et al*. (1976;1978;1979) in different areas of the Sudan. However, the real magnitude of Echinococcosis in domestic animals, wild animals and man in the Sudan is still unknown.

Idris (1985): reported that echinococcosis is prevalent in Khartoum province with varying degrees of incidence in different localities of the province. Man is often responsible for the presence of the hydatid disease by allowing dogs to eat the offal of his animals.

Saad and Magzoub (1986) carried out a survey of adult parasites in 50 stray dogs in Tumbool (Butana area) and they found the parasite in 51% of the examined dogs where they reported 24800 worms in one dog.

Tola (1987) investigated hydatidosis of camels, cattle and sheep in Butana and Khartoum and Sudanese camels exported to Egypt. He reported that the average prevalence rate in camels, cattle and sheep was 56.4, 2.1 and 2.0% respectively.

Saad and Magzoub (1989a and 1989b): conducted a survey of hydatidosis in areas representing all regions of the Sudan except the south. The overall prevalence rates they reported were 48.69, 3.84, 12.9 and 4.4% in camels, cattle, sheep and goats respectively.

Elhussien and Ali (1990) reported that the prevalence rate in camels was 37%.

El Sawi (1994) found that 8.9% and 4.21% of 1362 sheep and 164 goats respectively slaughtered at Omdurman central abattoir were infected with hydatid cysts.

Elsawi and Saad (1995) found that 43.9% of camels slaughtered at Omdurman slaughter house were infected with hydatid cysts.

Elansary and Hamad (1997) examined 400 head of sheep in Kassala slaughter house and reported that 122 (30.5%) were infected with hydatid cysts.

Mohammed and Elmalik (2000) carried out a survey in Nyala town. They reported existence of the cyst in camels and cattle.

Elmahdi (2003) carried out an abattoir survey for hydatidosis in camels, cattle and sheep in Omdurman, Tumbool and Madani. He reported the highest rate of infection in camels (45%), followed by sheep (7%), and cattle (3%).

Mohammed (2004) reported that camels in the Sudan can be considered as the main intermediate hosts for cystic echinococcosis.

1.9.2 Human hydatidosis in Sudan

Statistics which estimate the true prevalence of hydatid disease in man are not available in many countries and they depend upon reported positive surgical cases from governmental hospitals only. Other cases which fail to be admitted to hospitals are not reported.

Human hydatidosis in Sudan was first reported by Christopherson in 1909 (Saad, 1985). He gave his experience of 7 years service in the Sudan where he came across 6 cases. Two of the patients were Egyptians who got the disease from Egypt. The other 4 cases originated in the Sudan.

Eisa *et al*. (1962) reported the occurrence of hydatidosis as an endemic disease amongst Taposa tribe of Kapoeta District of the Equatoria province of southern Sudan.

Cahill *et al*. (1965) they reported that the disease was not uncommon in the south.

Tola (1987) observed a prevalence rate of about 1.2% in human population in Khartoum province.

Elmahdi (2003) conducted an ultra sound survey of 300 subjects by portable scanner. He diagnosed a single case of human hydatidosis in central Sudan.

1.10 Safe meat hygiene practices

Slaughtering of meat animals at abattoirs and safe disposal of infected organs play a major role in interrupting the transmission cycle. The effective supervision of disposal of condemned offal by incineration, boiling or deep burial an important part of

Echinococcosis controls. Dogs should be prevented from entering abattoirs. Illegal slaughtering must be prosecuted and special precautions must be taken when home slaughtering is carried out for social ceremonies (Gemmel *et al*., 2001).

1.11 Health education

Health education is a basic component of any programme for control of *Echinoccocus granulosus* and cystic echinococcosis. It requires the motivation and participation of various population groups and has to take into consideration believes, perceptions, behaviors, expectations, traditional habits, cultural and religious traditions, customs and needs of the people. The educational material should address local problems in order to be effective and have the needed impact on governmental officials, political decision makers, managers, farmers, health professionals, butchers, abattoir workers, dog owners, school-age and other educationally deprived children, field and laboratory workers and every one involved directly or indirectly in a control programme of Echinococcosis. The full socioeconomic impact which may be considerable in endemic areas has to be brought out clearly in order to alert the community on the need for control. The educational materials include audio-visual aids (video films, TV programmes), Mass media, poster, pamphets, pictures, brochures, coloring books and preserved adult *Echinococcus granulosus* and hydatid cyst (McPherson and Wachira, 1997; Gemmell *et al*., 2001). All sectors of society must have a role in decision-making and in implementing strategies to control or eliminate diseases of animals origin. Specific educational materials should always be matched to the educational level of the particular target group to obtain the best

results, and due attention should be paid to different religious beliefs, cultural customs and languages of local inhabitants. Appropriately prepared materials can be used to communicate information on disease to local communities, and to encourage them to adopt healthy lifestyles. Health educational programmes can be addressed to opinion leaders, schoolteachers, schoolchildren, parents/guardians, livestock producers and rural communities. Indigenous knowledge should be respected and used when effective.

The dissemination of information through the mass media is an essential element in preventing and controlling zoonotic diseases and promoting VPH programmes. Radio and television are valuable means for disseminating health education, but programmes should be clear, concise and designed to appeal to the target audience in order to be effective (Anon, 2002).

Accidental ingestion of garden vegetables, water, or soil contaminated with tapeworm eggs from dog feces initiates this infection, so it is important to educate populations in endemic areas about careful washing of hands and food. The feeding of livestock entrails to dogs is a common starting point for the tapeworm life cycle and should be avoided. Educational programs should be initiated early because, presumably, most infections are acquired in childhood (Anon, 2002). Prevention of *E. granulosus* in humans can be accomplished primarily through education and proper hygiene.

Veterinarians can be effective communicators of health messages, promote changes of attitudes, and exercise leadership in encouraging the community to organize and to promote public health. They can teach livestock producers about the transmission and prevention of zoonotic diseases, using animal diseases as examples.

Veterinary technicians, in addition to their role as veterinary assistants, can communicate their knowledge to the population at risk if they are well trained and understand the principles of VPH. Similarly, physicians can teach their patients about the transmission and prevention of zoonotic diseases. Nurses and other health personnel in close contact with patients also play an important role in health education. (Anon, 2002)

1.12 Diagnosis

Diagnosis of *E. granulosus* in the definitive host is accomplished by demonstrating the presence of adult cestodes (usually less than 6 mm long and possessing 2 to 6 proglottids) in the feces or in the upper one-third of the small intestine and identifying them using morphological characteristics (position of the genital pore, the uterus or the testes). Enzyme Linked Immunosorbent Assay (ELISA) tests for detecting coproantigens in the feces of canids can be used to test for *E. granulosus*. Coproantigens can be detected shortly after infection and prior to the release of eggs by the adult tapeworms. Serological testing can also be performed to determine the presence of oncosphere, cyst fluid, and/or protoscolex antibodies in the serum. This test however does not distinguish between current and previous infections and cross reactivity between *Echinococcus sp*. and *Taenia sp*. Identification of *E. granulosus* in definitive hosts is extremely important for both epidemiologic studies and surveillance of hydatid control programmes (Anon, 1981).

Diagnosis of *E. granulosus* in the intermediate host is accomplished through necropsy examination of the animal and identifying the larval cyst in the organs, usually the liver or the lungs.

Formalin fixed tissue positive on periodic-acid-Schiff (PAS) staining demonstrates a positive cellular laminated layer with or without an internal cellular nucleated germinal membrane (a specific characteristic of the metacestodes of *Echinococcus sp*.).In intermediate host (domestic animals) are usually examined for hydatidosis at licensed slaughterhouses during meat inspection. The cysts can often be visually detected in organs. However; they should be identified microscopically in the laboratory (Soulsby, 1982).

Diagnosis of *E. granulosus* in humans by using the primary approaches for clinical diagnosis of cystic echinococcosis like:

Imaging methods for detection of space-occupying masses include: Ultra-sonography (US), computed tomography (CT), radiology (X-ray) and magnetic resonance imaging (MRI) (Sinner, 1991).

1.13 Treatment

Treatment in definitive hosts can be accomplished by giving canids Praziquantel or Arecoline. Arecoline is a parasympathetic agent and increases the tonus and the mobility of smooth muscle resulting in the purgation of *E. granulosus* adults from the intestinal tract and passing them from the body in the mucus that follows the formed fecal material. The drug works by paralyzing the tapeworm, resulting in its relaxing its hold on the intestinal wall. Dosage with Arecoline is 1 tablet/10 kg. Body weight but pregnant bitches and animals with cardiac abnormalities should not be treated.

Treatment of cervid intermediate hosts is unnecessary as this parasite causes limited pathological damage and is not a significant mortality factor.

Treatment of human intermediate hosts consists of removal of the hydatid cyst(s). Removal of the cyst(s) is recommended for pastoral infections but cysts of Sylvatic origin may allow for a more conservative treatment. If surgery is performed to remove the cyst(s), a course of drugs (the drug of choice is Albendazole) is prescribed to kill any remaining tapeworm larvae that might still be in the body. The disease may not always be cured by surgery (Anon, 2007).

Therapy for echinococcosis is based on the size, location, and symptomatic complications of the cysts. Surgery is the treatment of choice; however, removal of the main cyst mass may not be 100 percent effective because small "daughter" cysts can be left behind. Chemotherapy (e.g., albendazole [Albenza] and mebendazole [Vermox]) is effective against tapeworm disease, and its use is indicated for the treatment of patients with inoperable disease or as presurgical and post surgical treatment to reduce the risk of recurrence. Ultrasonographic or computed topographic (CT) guided fine-needle aspiration of hydatid cyst contents followed by infusion of a killing agent, such as 95 percent ethanol, and reaspiration, known as PAIR therapy (Puncture, Aspiration, Injection, Reaspiration), has been used successfully at some centers but carries a risk of dissemination of infection or anaphylactic reaction caused by cyst puncture and leakage (Anon, 2002).

1.15 Control

E. granulosus has been viewed as highly vulnerable to the implementation of preventive measures. When only synanthropic hosts under human control are involved, the cestode cycle can be

interrupted if dogs are prevented from consuming infected viscera from sheep and other domestic ungulates (Thompson *et al*., 1995).

Control measures with proven usefulness against hydatid disease have included health education, stray dog control, registration of owned dogs, routine diagnostic testing and/or treatment of dogs, restrictions or controls on commercial and home slaughter of sheep and other livestock. Since the available technology has improved over the years, the degree and the rapidity of demonstrable progress has, in part, reflected the degree of sophistication of the technology. It may be expected that future progress in research, for example the possible development of an effective vaccine will further improve the technical possibilities for effective control (Heath and Lightowler, 1993).

Control of the parasite in wild canids is not feasible. Control in domestic canids can be accomplished by preventing the availability of hydatid-infected offal (do not feed dogs carcasses or allow them to scavenge) and a regular worming regiment with Praziquantel or Arecoline. A vaccine has not been developed for canids

Control of the parasite in livestock is possible through the use of a vaccine that has been developed utilizing a protein contained within the parasite's egg. The vaccine has not been successful in cervids

Eggs can be ingested either from handling a canid (either alive or dead) that may have eggs on its fur or by handling canid fecal material. Examination procedures of either animals or fecal material poses a risk of infection and potentially fatal disease to humans but this can be minimized by appropriate safety measures. Laboratory materials should be frozen at -80 degrees C for 48 hours. A disposable face mask, gloves, and coveralls should be worn whenever handling

animals or fecal material. Contaminated material must be destroyed by heat as chemical disinfection is not reliable.

There are no precautions that need to be taken when handling tissue of the intermediate hosts as the lung cysts are not infective to humans (Anon, 2001). The immediate prospects for further progress in control of hydatid disease depend upon the development of adequate surveillance systems and careful documentation of the disease in all important hosts in order to characterize the quantitative dynamics of transmission and the costs and benefits of different control strategies (Gemmell *et al*., 1986; Gemmel, 1987, 1993).

It must be noted that the positive achievements of successful control programmes, however significant at the local level, have not markedly changed the global distribution and public health importance of hydatid disease. (Anon, 1981)

1.16 Public health problem and risk factors

Information on the public health problems in Middle Eastern countries is largely based on reported clinical case series. Most of the major hospitals in the Middle East have CT, ultrasound and in some cases, MRI diagnostic imaging facilities and many autochthonous case reports exist for most countries; few community-based studies have been carried out, however, and few details are known about the epidemiology of the disease. A review of hospital records in Jordan indicated that the number of the recorded cases of hydatid disease increased each year between 1985 and 1991; the annual diagnostic incidence was estimated to vary from 15 to 65 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; 77 and 59 patients, respectively, were recently reported by Laajan and Nouh (1991) and Schaefer and Khan (1991).InSyria, 157 patients, accounting for 2% of all admissions at the university hospital, were seen over a 7 year period (Munzer, 1991). Hydatidosis is a disease of major public health importance in Iraq where over 500 human cases of the disease are seen annually (Matossian *et al*., 1977). Recently58 children (3-18 years of age) were treated surgically over a period of 2 years (Mahdi and Benyan, 1990), providing evidence of a high infection rate. In Iran, the average national surgical incidence of cystic hydatid disease is 1.2 per 100,000 but varies between 0.1 and 4.5 per 100,000 in different provinces. An annual incidence of 3.6 per 100,000 has been reported in Kuwait (Shweiki *et al*., 1990) but only 30% of the patients were Kuwaiti nationals. Hydatidosis has been reported to be more common among Christians than Muslims in Lebanon (Schwabe and AbouDaoud, 1961) and Israel (Yarrow *et al*., 1991), and is unknown in Somali Muslims in Kenya (MacPherson *et al*., 1989b). These differences have often been assumed to be the result of differences in degrees of contact with dogs. Islamic religious beliefs consider the dog an 'unclean' animal; dogs are rarely allowed inside Muslim houses and humans have little direct contact with dogs. Owned dogs are usually kept chained up outside the house. Although these cultural differences may limit exposure of Muslim populations to dog-transmitted pathogens, at least in comparison to their non-Muslim neighbors, they certainly have not excluded exposure to infection. In Lebanon, a resurgence of Echinococcosis since the outbreak of civil war in the mid-1970s has been noted, particularly in the Muslim majority areas of the country (Thompson *et al,* 1995). The extensive public health

problem among Muslim populations throughout the Middle East and northern Africa countries indicate that egg exposure occurs commonly via both direct and indirect means.

CHAPTER TWO
MATERIALS AND METHODS

2.1 Study area

The study was conducted in two sites: Khartoum and Gezira states.

The locations chosen were according to:

1. Representation of urban and rural setups.
2. State of health facilities.
3. State of slaughtering preparedness for disposal of discarded offal.
4. Community strata and degree of man-animal contact.

Table (1) showed locations of the study

2.2 Study groups

The target populations of this study are:

1. The specialist of medical fields (physicians, veterinarians, paramedical worker, public health and environmental workers).
2. Community members.{animal owners and housewives}.

2.3 Study Instruments

2.3.1 Questionnaires

One thousand questionnaires were filled between January to May 2009 to assess the level of knowledge of the specialist and awareness of the communities in some rural and urban areas in Khartoum and Tumbool areas about zoonoses, Echinococcosis and hazards from animals.

Table 1: Locations of the study

	Khartoum	Khartoum Bahri	Omdurman	Tumbool
Hospitals and clinics	18	13	19	-
Veterinary hospitals and units	8	15	7	-
Clinical Laboratories	19	10	11	-
Localities	1	1	1	-
High standard residential areas	11	9	8	2
Low standard residential areas	6	5	7	5

Respondents were inclusive of representatives from the following locations:

2.3.1.1 Hospitals and clinics

A total of 50 governmental and private hospitals and clinics were selected for assessment of the level of knowledge of 300 physicians about zoonoses and Echinococcosis. Those hospitals and clinics were distributed in Khartoum, Khartoum Bahri and Omdurman.

2.3.1.2 Veterinary hospitals and units

A total of 30 governmental and private veterinary hospitals and units were selected for assessment of the level of knowledge of 200 veterinarians about zoonoses and Echinococcosis, and distributed in Khartoum, Khartoum Bahri and Omdurman.

2.3.1.3 Clinical diagnostic laboratories

A total of 40 laboratories were selected for assessment of the level of knowledge about zoonoses and Echinococcosis of 200 technicians and specialists of diagnostic imaging and 50 veterinarians in diagnostic laboratories.

2.3.1.4 Health officers and Environmental workers

A total of 3 localities were selected in Khartoum, Khartoum Bahri and Omdurman for assessment of the awareness of 50 public health and environmental workers about zoonoses, Echinococcosis and health hazards from animals.

2.3.1.5 Animal owners and housewives

A total of 100 animal owners in Khartoum and Tumbool area were involved to assess the level of awareness about the health hazards and zoonoses.

Housewives of 100 families were selected to assess the level of awareness about zoonoses and health hazards from animals. The study involved families from Tumbool area, representatives from variable living strata from high to low in Khartoum.

To every group special types of questions were designed depend on their occupation and duties.

Questionnaire designs appeare as Appendix.

2.3.2 Estimation of prevalence of cyst in slaughtered animals

2.3.2.1 Field examinations in Tumbool slaughter slab

Tumbool area has a large market of livestock and high number of animals are slaughtered per market for consumption .Different species were examined for hydatid cyst at the weekly large market.

Observations were made on the slaughter conditions.

2.3.2.2 Laboratory examination for detection of hydatid cysts

After field examination, aspirated fluid from the collected cysts from slaughtered animals were examined under the microscope to confirm the field diagnosis.

201 camels and 195 sheep/goats were inspected.

2.3.3 Extention programmes

Persistence of hydatid cysts in animals and humans is assumed to be due to low awareness, which entail that extension programmes need to be designed to improve the control efforts.

CHAPTER THREE

RESULTS

3.1 Questionnaires

3.1.1 Academic status of the respondent professionals

All physicians, veterinarians and paramedical staff had first degree training, (46.6%) physicians, (40.0%) veterinarians, (20%) paramedical technicians and (24%) public health workers had postgraduate training (Fig. 1).

On the other hand attendance of short training courses was (51.3%) for physicians, (55.2%) veterinarians and (65%) paramedical including public health workers (Fig. 2).

3.1.2 Animal relationships and the risk of this relations

The study showed the relationship of animal owners with animals depend on economic reasons and they think that there is no risk from there animals and the specialist think that the risk come from diseases (Table 2 and 3).

3.1.3 The knowledge of specialists about zoonoses

The study revealed that the veterinarians know more than the others about zoonoses. Rabies is the well known disease for all groups (Figs. 3).

3.1.4 The knowledge of specialists about viral, bacterial and parasitic zoonoses

Diseases most mentioned include Rabies, Rift vally fever and Avian enfluenza. Some diseases were not mentioned as Jungle yellow fever, sindbis fever, Marburgedisease and Crimean heamorrage fever. However in most cases veterinarians know more about zoonoses than others.

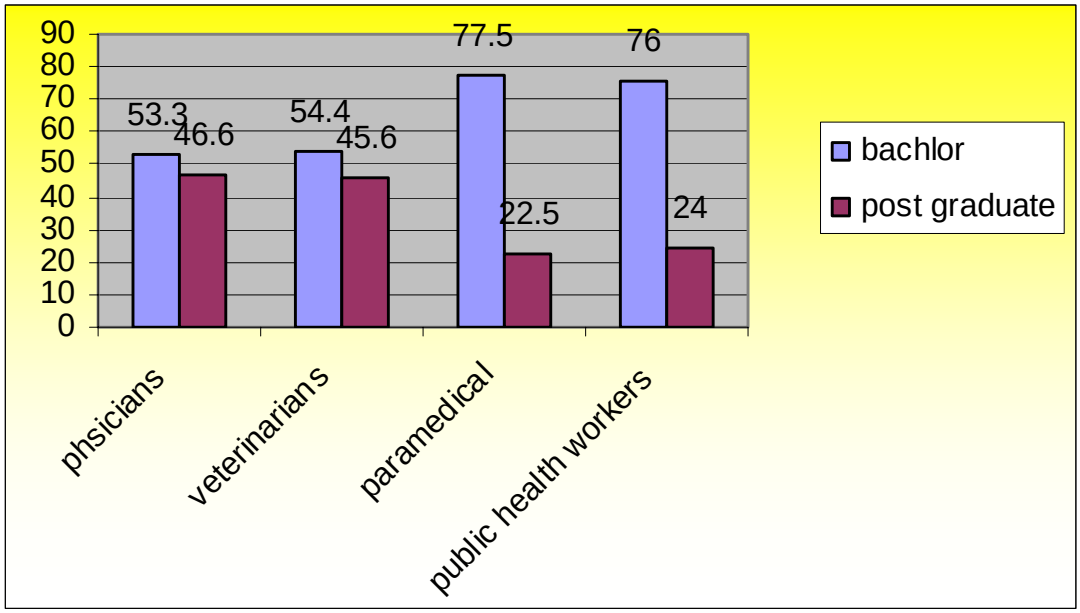

Fig. 1: Academic status of the respondent professionals

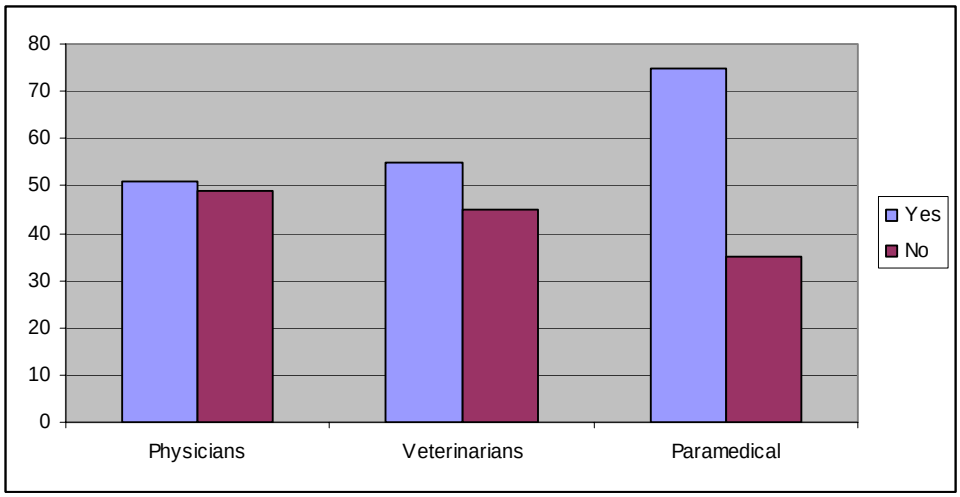

Fig. 2: Attendance of professional training courses

Table 2: Animal relationships

Animal relationship	Physicians	Veterinarians	Paramedical	Animal owners
Grazing	0	0	0	0
Company	9.3%	0	15%	22%
Riding	4%	0	2%	18%
Entertainment	17%	0	4.5%	11%
Economic reasons	0	0	0	68%
Care	8%	61.2%	2%	0
No relation	61.7%	38.8%	76.5%	0

Table 3: Risk of animal relationships

Risk of relationship	Physicians	Veterinarians	Paramedical	Animal owners
Harmfulness	44%	17.2%	6.5%	72%
Diseases	67.3%	62.4%	70.5%	12%
No risk	7%	20.4%	23%	88%

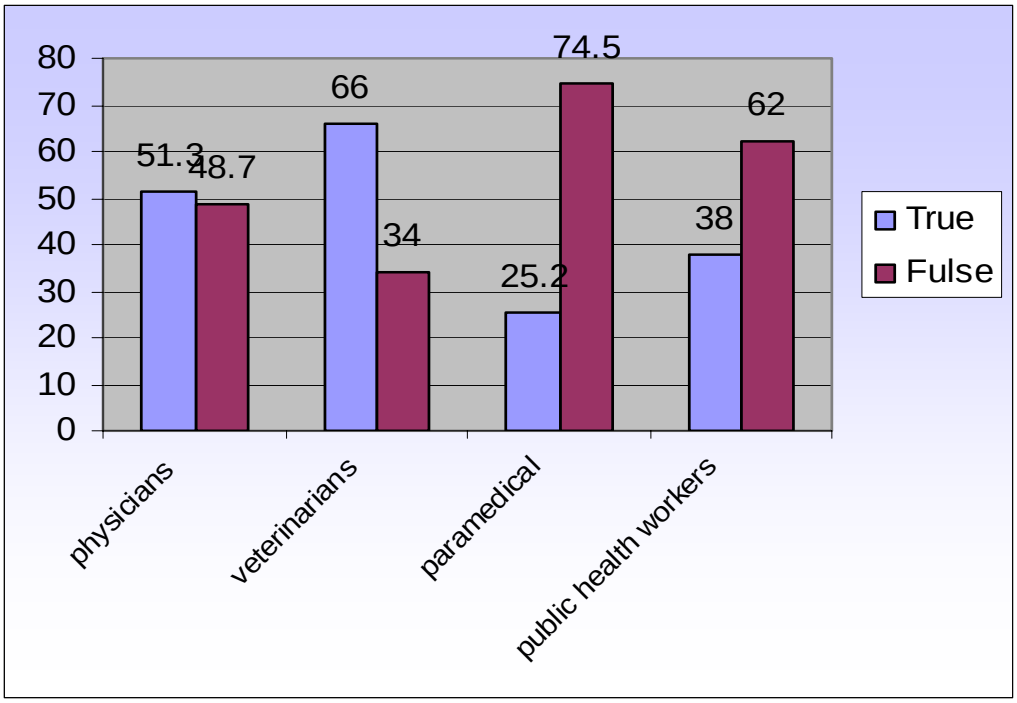

Fig. 3: Knowledge of specialists about zoonoses

The study revealed that Anthrax is well known disease and the veterinarians know more about Hydatidosis. The other specialists know the Hydatidosis from the questionnaire (Figs. 4, 5 and 6).

3.1.5 The knowledge of the community about the diseases transmitted from the dogs

The study revealed that rabies is a common disease known by community, on the other hand the community have limited knowledge about Echinococcosis (Figs. 7 and 8)

3.1.6 The source of scientific information for physicians and veterinarians

The books are the main source of scientific information of the physicians and veterinarians (Table 4).

3.1.7 The institutions responsible for extension and awareness about zoonoses

The study revealed the specialists think that the Ministry of Animal Resource, Ministry of Health in addition to mass media are completely responsible for the extension and awareness about zoonoses (Table 5).

3.1.8 Knowledge of physicians and veterinarians about hydatidosis in their respective fields

The study revealed that 66% of physicians did not know the source of infection although more than 50% know clinical signs.47.3% know diagnosis and 54% know treatment. As for veterinarians their knowledge of life-cycle 59.6%, prevention and control 70.8% and clinical signs were above 50%. The lower percentages were in treatment 25.2% and diagnosis 39.6% (Figs. 9 and 10).

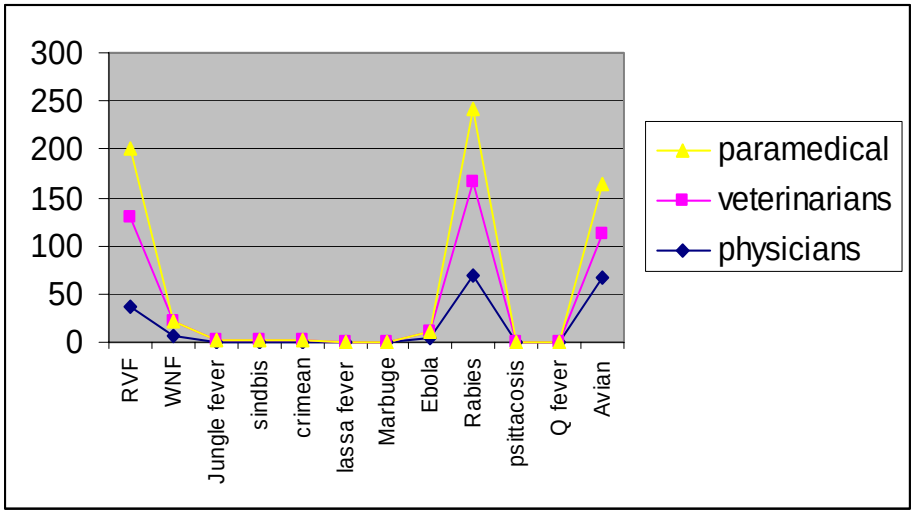

Fig. 4: Knowledge of specialist about viral zoonoses

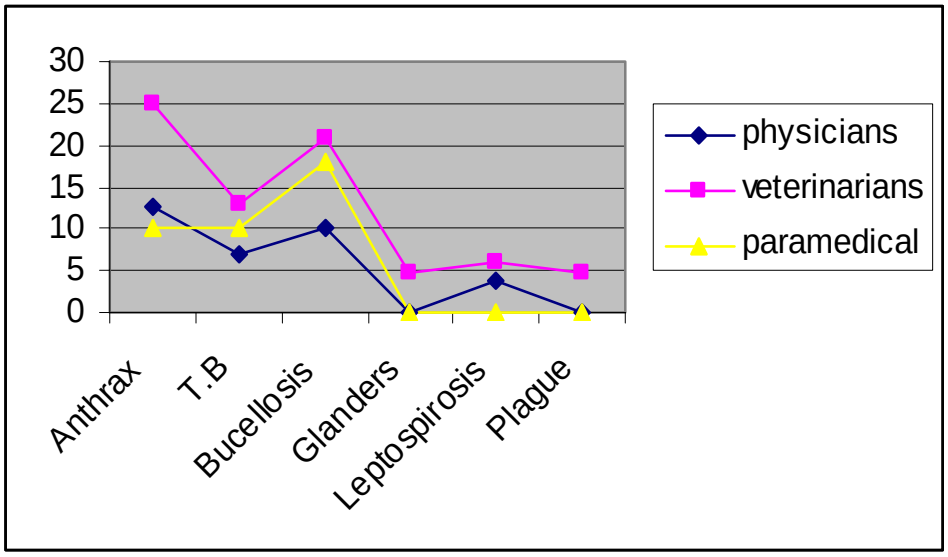

Fig. 5: Knowledge of specialist about bacterial zoonoses

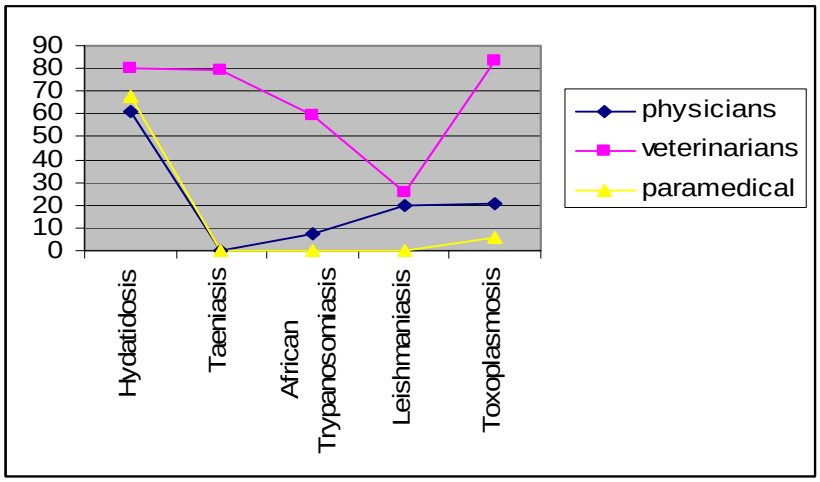

Fig. 6: Knowledge of specialist about parasitic zoonoses

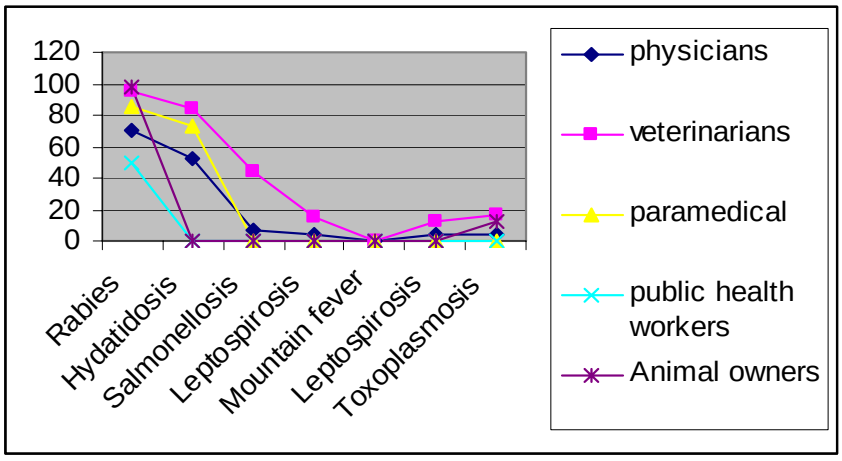

Fig. 7: Knowledge of specialist and community about diseases transmitted from dogs

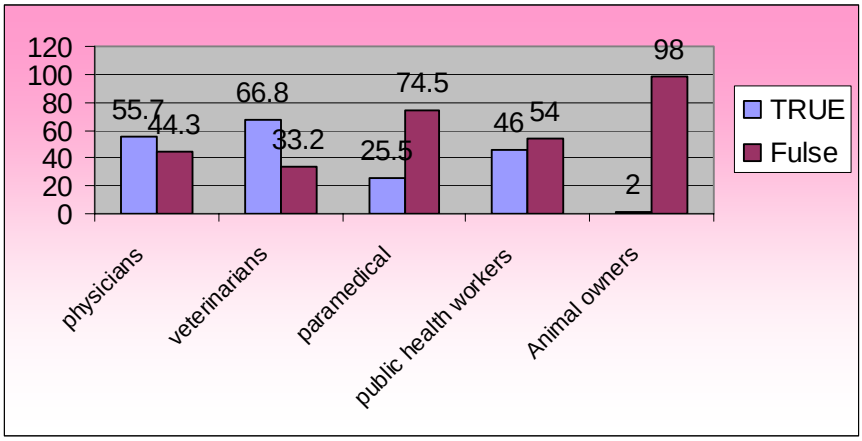

Fig. 8: Knowledge of specialist and community about Hydatidosis

Table 4: Source of scientific information

Source of information	Physicians		Veterinarians	
	Frequency	Percentage	Frequency	Percentage
magazines	120	40	35	14
Books	254	84.7	98	39.2
Forums	23	7.7	50	20
Reports	45	15	13	5.2
Internet	88	29.3	54	21.6

Table 5: Institutions responsible for extension

Institutions responsible for extension	Physicians		Veterinarians	
	Frequency	Percentage	Frequency	Percentage
Ministry of animal resources	204	68%	241	96.4%
Ministry of health	212	70.7%	210	84%
Localities	138	46%	40	16%
Universities	152	50.7%	65	26%
Professional unions	48	16%	0	0
Mass media	299	99.7%	234	93.6%

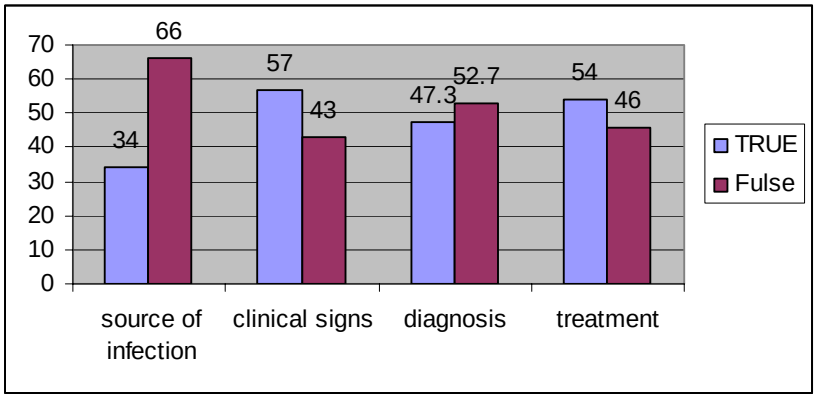

Fig. 9: Knowledge of physicians about Hydatidosis

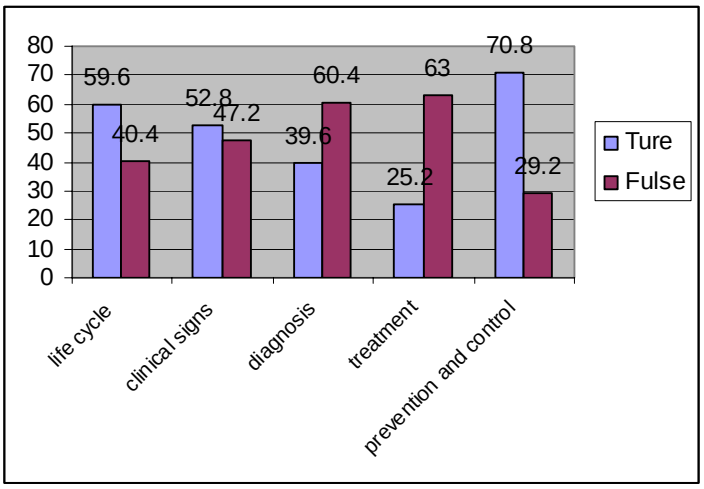

Fig.10: Knowledge of veterinarians about Hydatidosis

3.1.9 The knowledge of paramedical about hydatidosis

The study showed that paramedical staff had very little knowledge on diagnostic methods (27.5%), sample collection (20%) and cyst morphology (17.5%) (Fig. 11).

3.1.10 Diagnosis of Hydatid cyst by the technicians and specialist of diagnostic imaging

The study showed out of 20 suspected cases, 10% found positive for hydatid cyst.

3.1.11 Hydatidosis control and extension programmes:

The study revealed poor attention in localities for control (2%) and extension (8%) of Hydatidosis.

3.1.12 Veterinary care

The study revealed little veterinary care for animal in the houses and farms, 17% for periodical care and 83% when necessary.

3.1.13 owned animal by the people

The study showed pets animals (dogs and cats) are the main owned animals (Table 6).

3.1.14 Main meat source and lesions observations:

The study revealed the butcher shops are the main meat source and lesions observed in slaughter at house level (Table 7).

3.1.15 Lesions disposal by the housewives:

The study showed wrong lesions disposal. 88% public rubbish, 2% incineration and 10% burial.

3.1.16 Animal species in the houses

Pet animals appear in large numbers than the others. Cats (68%), dogs (22%) and (10%) other species.

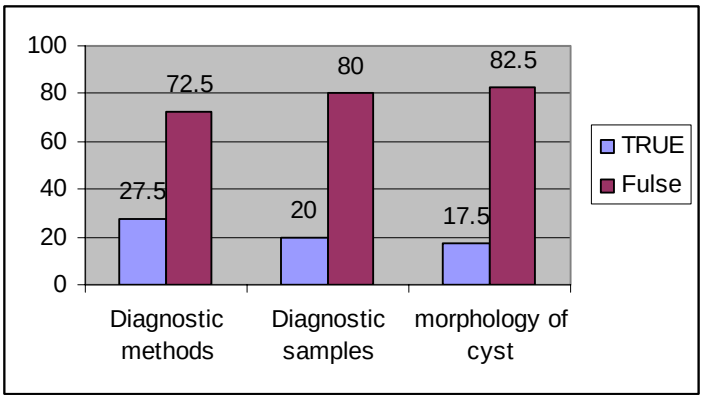

Fig. 11: Knowledge of paramedical about Hydatidosis

Table (6): Pet animals (dogs and cats) are the main owned animals

Animal species	Percentage
Cats	62
Dogs	51
Sheep	14
Goat	22
Cows	56
Camels	2
Others	18

Table (7): Main meat source of 100 respondents

	Butcher shop (%)	Slaughter at home level (%)	Both (%)
Source of meat	92	2	6
Lesions observed	2	98	0

3.1.17 Favorite media

Watching T.V (98%) appearing the favorite media for communities to fallow up the events and news. Radio (82%), Newspapers (13%) and Others (7%)

3.2 Estimate prevalence of cyst in slaughtered animals:

3.2.1 Field examination at Tumbool slaughter slab

Although Tumbool area has a large market of livestock, it has poor slaughter slab (Plate 1).

Slaughtering of all animals and inspection of meat were done on the ground (Plate 2).

Field examinations of Hydatid cyst in slaughtered animals shown in table (8) revealed 40 positive cases (19.9%) from total of 201 slaughtered camels.

- Out of 195 sheep/goat, 20 (10.2%) were found to harbor hydatid cyst.
- All hydatid cysts from slaughtered camels found deeply in the lung tissues.
- Camel lungs are one of the offal contents and throw for dogs and this promote the parasite cycle (Plate 3).
- Camel lungs are one of the offal contents and the slaughterhouse workers were allowing dogs to eating the offal. (Plate 5).
- In all slaughtered camels positive for hydatid cyst, the cyst found deeply in the lung tissues.
- Large numbers of dogs roam about and around the slaughter slab (Plate 6).

Plate 1: Tumbool slaughter slab

Plate 2: Slaughtering of animals

Table 8: Meat inspection for hydatid cyst at Tumbool slaughter slab

		Number of observations					
		1	2	3	4	5	Total
Camels	Slaughtered animals	45	37		33	39	201
	Positive cases	15	5	6	6	8	40
Cattle	Slaughtered animals	16	18	26	20	18	98
	Positive cases	0	0	0	0	0	0
Sheep/goat	Slaughtered animals	36	40	43	36	40	195
	Positive cases	3	5	6	0	6	20

Plate 3: Disposal of camels lungs

Plate 4: Meat transportation

Plate 5: Stray dogs eating the offal

Plate 6: Large numbers of stray dogs around the slaughter slab

3.2.2 Laboratory examination

Laboratory examinations revealed misdiagnosis of hydatid cyst in the field (Table (9).

Total of 40 cysts from201 slaughtered camels was appear positive for hydatid cyst.

Out of 195 slaughtered sheep/goat, 20 found to harbor cysticercus tenuicollis not hydatid cyst.

Table (8): meat inspection for hydatid cyst at Tumbool slauter slab:

3.3 Example for T.V programme or video about zoonoses for the target groups

Because the T.V is appearing the favorite media can be design effective and easy message via T.V.

Objectives: The programme aim at define zoonotic diseases, health hazards from animals and the control of zoonotic diseases.

Table (9): Laboratory identification of collected cysts

Animal species	Hydatid cyst		Cysticercus tenuicollis	
	Number examined	Positive	Number examined	Positive
Camels	201	40(19.9%)	201	0%
Sheep/goats	195	0%	19 5	20(10.2%)

Time : 25 min.
Script :

Series	Objective	Time	Subject	Observations
1	Introduction about the objective of the series	2 min.	Introduction about the objective in attractive form	---
2	Report about the definition of zoonoses	5 min.	Pictures or video about the diseases	Video about the disease in human and animals
3	Control of zoonotic disease- dialogue with the specialist	8 min.	Specialist of zoonoses	---
4	Control of Hydatidosis with emphasis on the best ways of control	7 min.	Report about zoonotic disease with the idea of target groups	Video about stray dogs, pets animal in houses
5	Conclusion	3 min.	Abstract of the subject in easy and attractive form	----

CHAPTER FOUR
DISCUSSION

All previous studies on Hydatid disease were concentrated on the epidemiological aspects of the disease, existence of the disease in Sudan, the incidence rate and prevalence rate. For example, Idris (1985) conducted a study on some aspects of epidemiology of echinococcosis/hydatidosis in the Sudan, Elkhawad *et al.* (1968) make studyies on the incidence of helminth parasites in ruminants slaughtered in the Western province of the Sudan and Saad *et al.* (1983) conducted a study on some observations on the prevalence and pathology of Hydatidosis in Sudanese camels.

The present study was designed to assess the level of knowledge of the specialist of medical fields and the communities about zoonotic diseases, specially the Hydatidosis because this is one of important zoonoses transmitted from dogs. In Sudan, the incidence of Echinococcosis has probably increased in recent years as a result of increased ownership of dogs, and presence of stray dogs in close contact with people in markets and around the slaughter houses. Also the slaughter practices in Sudan play a vital role in maintenance of the parasite cycle because of low quality and number of slaughter houses. In addition slaughter at house level without any practices of safe slaughter increases chances of maintenance of the parasite.

The entire specialist who participates in the questionnaire work in different institutions in Khartoum state because it has good health and veterinary services and more advanced when compared with the other states.

Physicians, paramedicals, public health officers and environmental workers know little about zoonoses including Echinococcosis .On the other hand Veterinarians know more than the others about zoonoses and Echinococcosis but they put little efforts to transmitted their knowledge to the communities.

Communities are well aware about Rabies as a disease transmitted from dogs but they have little idea about other important diseases transmitted from dogs and have a wide host range for example Hydatidosis.

In Tumbool area, the slaughter slab provides a good environment for the disease incidence and prevalence, because the slaughter slab has no infra-structure to serve as a slaughterhouse. Large numbers of dogs roam about and around the slaughter slab. Hydatid cysts from camels were found in the lung tissues this agrees with Saad and Magzoub (1989b). Camel lungs are the parts of the offals that are not consumed. The slaughterhouse workers allow dogs to eating the offal and that promote the parasite cycle.

The presence of large number of stray dogs and improper disposal of infected offals suggest an on-going cycle of dog-camel dog in Tumbool area and that humans are at high risk in this area.

The study revealed that pet animals are found in large number in the houses with low veterinary care. Slaughter at house level with improper disposal of infected offals suggest an on-going cycle of dog-intermediate host-dog cycle.

The result of meat inspection for hydatid cyst revealed the presence of cysts of cysticercus tenuicollis and the cyst of hydatid in

the slaughtered animals at the slaughter slab and this leads to field misdiagnosis.

The present study differs from all above by addressing gaps in knowledge and practice in public health aspects of the disease. Educational aspects about zoonosis were only touched when there is an epidemic (Rift Valley Fever, Rabies and Avian influenza).However there is need for general awareness raising to manage slow developing zoonosis.

Tacking Echinococcosis as an example the gaps in knowledge were very clear among the different groups of specialists and between them and the general community.

It is clear that all sectors have one or more communication medium that could be used to transmit extension messages, T.V. stands first among media channels. It is therefore important to select areas of knowledge gaps, design message to be available for specialists and communities.

CONCLUSIONS AND RECOMMENDATIONS

1. The physicians, paramedical, public health and environmental workers know little about zoonoses and Echinococcosis. On the other hand veterinarians know more about zoonoses and Echinococcosis.
2. The communities have the least knowledge about zoonoses and Hydatidosis and more information need to pass to them.
3. There was misdiagnosis in the slaughter houses for hydatid cyst.
4. The T.V was appearing the strong weapon to fight the ignorance of the communities about zoonoses and Echinococcosis.
5. The physicians, veterinarians, paramedical, public health and environmental workers considered the sponsors of public health and should work together to achief the public health aims. This could be achieved by a national public health forum.
6. Veterinarians can be effective communicators of health messages, promote changes of attitudes, and exercise leadership in encouraging the community to organize and to promote public health. This need to be recognized by other professions and by the government.
7. Further studies on the public health and Health education are needed in our communities. The communities must be aware of the zoonoses and public health because community participation is essential for the success of public health programmes.
8. Involvement of mass media in apprehension, preparation and dissemination of extension messages is vital for both health and social development.

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APPENDICES

Appendix (1)

استبيان للاطباء

الموضوع : مدى المعرفة بالامراض المشتركة بين الانسان و الحيوان وخاصة مرض الاكياس العدارية Hydatid Cysts

التاريخ: / /2009

رقم الاستمارة/.....

اسم مدون الإستمارة/.....

1-الاسم:.....

2- جهة العمل:.....

3-المؤهل الاكاديمي: (أ) فوق الثانوي

بكلاريوس ☐ دبلوم ☐

(ب) فوق الجامعي ☐ التخصص ☐

4- الدورات التدريبية المهنية التي إلتحقت بها:

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.....

.....

5- ماهي علاقتك المباشرة بالحيوان:

الرعي ☐ الترفيه ☐

الرفقة ☐ العلاج والرعاية ☐

الركوب ☐ لا توجد ☐

6- ما هي مخاطر العلاقة بالحيوان:

إصابة بالاذي ☐

أمراض ☐

لا توجد ☐

7- ماذا تعرف عن الأمراض المشتركة بين الإنسان والحيوان Zoonoses:

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.....

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8- أذكر الأمراض المشتركة التى تعرفها:

1-..... 4-.....

2-..... 5-.....

3-..... 6-.....

9- أذكر الأمراض المشتركة المتناقلة من الكلاب:

1-.....

2-.....

-3.....

10- ماذا تعرف عن مرض الأكياس العدارية: Hydatid cycts

11- ما هو مصدر العدوى للانسان:

12- ما هي الأعراض التي تظهر على الشخص المصاب:

13- كيف يتم التشخيص:

14- كيف يتم العلاج:

15- ما هي مصادر معلوماتك العلمية: مجلات ☐ كتب ☐

تقارير ☐ انترنت ☐ ندوات ☐

16- ما هي المؤسسات المسؤلة عن التوعية بالأمراض المشتركة

أ- الثروة الحيوانية ☐ د- الجامعات والمؤسسات التعليمية ☐

ب- الصحة ☐ هـ - الاتحادات المهنية ☐

ج- المحليات ☐ و- الإعلام ☐

Appendix (2)

استبيان للاطباء البيطريين

الموضوع : مدي المعرفة بالامراض المشتركة بين الانسان و الحيوان وخاصة مرض الاكياس العدارية Hydatid Cysts

التاريخ: / /2009

رقم الاستمارة/.....

اسم مدون الإستمارة/.....

1-الاسم:.....

2-جهة العمل:.....

3-المؤهل الاكاديمي: (أ) فوق الثانوي

بكلاريوس ☐ دبلوم ☐

(ب) فوق الجامعي ☐ التخصص ☐

4-الدورات التدريبية المهنية التي إلتحقت بها:

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.....

.....

5- ماهي علاقتك المباشرة بالحيوان:

الرعي ☐ الترفيه ☐

الرفقة ☐ العلاج والرعاية ☐

الركوب ☐ لا توجد ☐

6- ما هي مخاطر العلاقة بالحيوان:

إصابة بالاذي ☐

أمراض ☐

لا توجد ☐

7- ماذا تعرف عن الأمراض المشتركة بين الإنسان والحيوان Zoonoses:

.....

.....

.....

8- أذكر الأمراض المشتركة التى تعرفها:

1-..... 4-.....

2-..... 5-.....

3-..... 6-.....

9- أذكر الأمراض المشتركة المتناقلة من الكلاب:

1-.....

2-.....

3-.....

10- ماذا تعرف عن مرض الأكياس العدارية: Hydatid cysts

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11- ما هي دورة حياة الطفيل:

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12- الأعراض التي تظهر على الحيوان Intermediat host & final host

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13- أين وكيف يتم التشخيص:

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14- ما هو العلاج:

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15- ما هي طرق الوقاية والسيطرة على الطفيل:

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16- ما هى طرق الوقاية والسيطرة على الطفيل:

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.....

17- ما هى مصادر معلوماتك العلمية: مجلات ☐ كتب ☐ تقارير ☐

انترنت ☐ ندوات ☐

18/ ما هى المؤسسات المسؤلة عن التوعية بالأمراض المشتركة

أ- الثروة الحيوانية ☐ د- الجامعات والمؤسسات التعليمية ☐

ب- الصحة ☐ هـ - الاتحادات المهنية ☐

ج- المحليات ☐ و- الإعلام ☐

Appendix (3)

استبيان للكوادر الطبية المساعدة

الموضوع : مدي المعرفة بالامراض المشتركة بين الانسان و الحيوان وخاصة مرض الاكياس

العدارية Hydatid Cysts

التاريخ: / /2009

رقم الاستمارة/.....

اسم مدون الاستمارة/.....

1-الاسم:.....

2-جهة العمل:.....

3-المؤهل الاكاديمي: (أ) فوق الثانوي

بكلاريوس ☐ دبلوم ☐

(ب) فوق الجامعي ☐ التخصص ☐

4-الدورات التدريبية المهنية التي إلتحقت بها:

.....

.....

.....

5- ماهي علاقتك المباشرة بالحيوان:

الرعي ☐ الترفيه ☐

الرفقة ☐ العلاج والرعاية ☐

الركوب ☐ لا توجد ☐

6- ما هي مخاطر العلاقة بالحيوان:

إصابة بالاذي ☐

أمراض ☐

لا توجد ☐

7- ماذا تعرف عن الأمراض المشتركة بين الإنسان والحيوان Zoonoses:

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.....

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8- أذكر الأمراض المشتركة التى تعرفها:

1-..... 4-.....

2-..... 5-.....

3-..... 6-.....

9- أذكر الأمراض المشتركة المتناقلة من الكلاب:

1-.....

2-.....

3-.....

10- ماذا تعرف عن مرض الأكياس العدارية: Hydatid cysts

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11- ماهي طرق التشخيص لهذا المرض:

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12 ما هي العينات المناسبة للتشخيص:

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13- ما هو شكل Cyst وكيف يتم التفريق بينه وبقية الأكياس:

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14- هل قمت بالاشتباه في عينات مصابة؟ وما نسبة المرجب منها:

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Appendix (4)

استبيان لكوادر الصحة والبيئة

الموضوع : مدي المعرفة بالامراض المشتركة بين الانسان و الحيوان وخاصة مرض الاكياس العدارية Hydatid Cysts

التاريخ: / /2009

1) الاسم:.....

2) المؤهل الاكاديمي:

فوق ثانوى ( ) فوق جامعى ( )

3) ماذا تعرف عن الأمراض المشتركة بين الإنسان والحيوان Zooneses:

.....

.....

.....

4) أذكر الأمراض المشتركة التى تعرفها:

1- ..... 4- .....

2- ..... 5- .....

3- ..... 6- .....

5) أذكر الأمراض المشتركة المتناقلة من الكلاب:

1- .....

2- .....

3- .....

6) ماذا تعرف عن مرض الأكياس العدارية Hydatid Cyst:

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7) ما هى برامج مكافحة وطرق السيطرة على المرض

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8) هل توجد برامج مكافحة خاصة بمرض Hydatid Cyst:

نعم ( ) لا ( )

9) هل توجد برامج توعية وإرشاد بخطورة هذا المرض:

نعم ( )

لا ( )

Appendix (5)

استبيان أصحاب الحيوانات

الموضوع : مدي المعرفة بالامراض المشتركة بين الانسان و الحيوان وخاصة مرض الاكياس العدارية Hydatid Cysts

التاريخ: / /2009

1) الاسم:

2) الهدف من إمتلاك الحيوانات:-

1- الترفيه ( )

2- الركوب ( )

3- العلاج والرعاية ( )

4- أسباب اقتصادية ( )

5- الرفقة ( )

3) انواع الحيوانات التى تمتلكها:-

قطط ( )

كلاب ( )

ضأن ( )

ماعز ( )

أبقار ( )

إبل ( )

أخرى ( )

4) مخاطر العلاقة بالحيوان:-

إصابة بالأذى ( )

أمراض ( )

لا توجد ( )

5) الرعاية البيطرية للحيوانات التى تمتلكها:-

1- رعاية دورية ( )

2- عند الضرورة ( )

6) اكثر وسائل الإعلام متابعة:

التلفاز ( )

الإذاعة ( )

الصحف اليومية ( )

أخرى ( )

7) ما هى الأمراض التى تعرفها المنقولة من الكلاب:-

السعر ( )

الأكياس العدارية ( )

السالمونيلا ( )

Leptospirosis ( )

Mountain fever ( )

Leishmania ( )

Toxoplasmosis ( )

Appendix (6)

استبيان ربات المنازل

الموضوع : مدي المعرفة بالامراض المشتركة بين الانسان و الحيوان وخاصة مرض الاكياس العدارية Hydatid Cysts

التاريخ: / /2009

1) المصدر الرئيسي للاستهلاك اليومى للحوم هو:

1- الجزارة ( )

2- الذبح بالمنازل ( )

3- أخرى ( )

**2) وجود اى تغيرات أو إشتباه في اللحم مرتبط مع أى من المصادر:- **

1- الجذارة ( )

2- الذبح بالمنازل ( )

3- أخرى ( )

3) طريقة التصرف في الآفات:-

1- النفايات العامة ( )

2- الحرق ( )

3- الدفن ( )

4) أمتلاك أو وجود حيوانات بالمنزل:-

1- قطط ( )

2- كلاب ( )

3- أخرى ( )

5) هل لك معرفة بمرض الأكياس العدارية:-

توجد ( )

لا توجد ( )

6) ما هى اكثر وسائل الإعلام متابعة:-

1- التلفاز ( )

2- الراديو (الإذاعة) ( )

الصحف اليومية ( )

أخرى ( )