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Some Epidemiological Aspects of Hydatidosis of Lungs and Livers of Sheep and Goats in Quetta, Pakistan

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Abstract.- To determine prevalence, intensity and fertility ratio of hydatid disease in sheep and goats in the district of Quetta, a survey was conducted in Army Supply Corps abattoir between August 2001 and March 2002. Overall incidence of hydatid disease in livers of sheep and goats was 46.74 and 23.28%, while in lungs these were 17.37 and 13.68%, respectively. Intensity of the metacesode was higher in livers. Fertile cysts being 66.46 and 52.17% in sheep and goat livers, while 95.29 and 58.82% in sheep and goat lungs, respectively. The factors responsible for prevalence, intensity and fertility of hydatid disease are discussed.

Key words: Hydatidosis of lungs, hydatid disease in sheep and goat, zoonotic disease, *Echinococcus*, Quetta.

INTRODUCTION

Hydatidosis is an important economic and zoonotic disease, caused by metacestode of adult worms of the genus *Echinococcus.* It commonly develops in dogs, although several other carnivores can also act as definitive hosts; ungulates are the intermediate hosts (McManus and Smyth, 1986). Genus *Echinococcus* consists of four species, *E. granulosus, E. multilocularis, E. vogeli* and *E. oligarthrus* (Bowles *et al.*, 1995). Thompson and Lymbery (1996) proposed three more species and their strains *E.* sp., *E. ortleppi* and *E. equinus* on the basis of host-parasite interaction and their probable geographical distribution. The dog-sheep cycle has been reported to be predominant for *E. granulosus* (Altintas *et al*., 1999).

Fertility of hydatid cysts is very necessary to be determined in surveys of hydatidosis, because it gives an idea about the diversity and level of threat in a particular area from different species of *Echinococcus,* especially the species that are dangerous for the general public. This paper reports some epidemiological aspects of hydatid disease in sheep and goats based on survey of slaughtered animals at Quetta, Pakistan.

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MATERIALS AND METHODS

A survey was conducted at Army Supply Corps (ASC) abattoir, Quetta between August 2001 and March 2002 to determine the status of hydatid disease in sheep and goats. Hydatid cysts were isolated from organs and after washing in tap water were preserved in 70% ethanol or occasionally in formaline. The later gave good results by forming very less or no residues in cysts, thus facilitating staining and mounting of protoscolices. Hydatid cysts were discriminated into three categories *i.e*., fertile, viable and nonviable as adapted by Larrieu *et al*. (2001). They were called fertile if containing protoscolices and germinal membrane; viable if containing germinal membrane only; nonviable if containing neither. For this nearly all the hydatid cysts were ruptured, except a few that were spared for the museum.

RESULTS AND DISCUSSION

Incidence

In sheep, a total of 122 out of 261 livers examined were found infected with hydatidosis making overall percentage infection 46.74% (Table I). In Pakistan, lower incidence has been reported by different workers, such as 24% by Iqbal *et al*. (1986a), 8% by Hayat *et al*. (1986), 14.8% by Iqbal *et al*. (1989), 2.83% by Anwar *et al*. (1993), 15.9%

by Iqbal *et al*. (1995). All these workers studied the status of hydatidosis in the city of Faisalabad. Ellis *et al.* (1993) in southern and central Sierra of Peru, EI-Metenawy (1999) in Saudi Arabia, and Mehrabani *et al*. (1999) in Shiraz, Iran found 6.5, 2.13 and 2.09% incidence, respectively, in livers. Nevertheless, high infection of 64% was reported by Moro *et al*. (1997) in central Peruvian Andes. Larrieu *et al*. (2001) found 50% sheep in Rio Negro province of Argentina whose livers were infected, whereas 29.4% showed involvement of both the lungs and livers.

Overall incidence of hydatidosis in liver of goats was 23.28%. Anwar *et al*. (1993) and Iqbal *et al*. (1995) in Faisalabad, Islam *et al*. (1995) in Bangladesh and EI-Metenawy (1999) in Saudi Arabia though have reported lower hydatidosis, they did not report it separately for livers and lungs. They reported an overall infection of 0.43, 7.7, 11.13 and 2.13% respectively. Iqbal *et al*. (1989) found 5.9% infection in goats at Faisalabad; however, majority of them were in lungs. Sharkhuu (2001) observed a respective prevalence of 2 and 3% in goats of steppe and forest steppe-zones of Mongolia. Similarly, Mehrabani *et al.* (1999) reported 2.17% incidence in livers of goats.

In our study, a total of 41 (17.3 7%) out of 236 sheep lungs had hydatidosis. Hayat *et al*. (1986) reported 12% infection in lungs of goats of Faisalabad. They in addition also reported 4% animals having hydatidosis in both their lungs and livers. An 8.3% infection was reported by Ellis *et al.* (1993) from Central and Southern Sierra of Peru. A very low prevalence (2.68%) was reported by Mehrabani *et al*. (1999). Moro *et al*. (1997) from central Peruvian Andes however, reported a very high prevalence of 86%.

A total of 13 (13.68%) goat lungs were found infected out of 95 examined. Iqbal *et al*. (1986b) found 8% infection of hydatid disease in teddy goats of Faisalabad. Mehrabani *et al.* (1999) found even far lower infestation rate of 2.36% in lungs of goats in Shiraz, Iran. Iqbal *et al*. (1989) reported a prevalence of 5.9% in goats of Faisalabad, majority being in lungs (54.9%). In addition, they also reported 19.5% cases involving both lungs and livers. Iqbal *et al*. (1995) reported 7.7% hydatidosis in goat lungs and livers.

Intensity

Mean intensity of hydatid cysts in liver of sheep was 4 (range 1-28). However, in contrast, a very low mean intensity was found in goat liver *i.e*., 2 (range 1-6). Similarly, higher intensity of hydatid cysts was found in lungs of sheep compared with goats. They had, on an average, 2 (range 1-9) and 1 (range 1-2) hydatid cysts, respectively (Table I). EI-Metenawy (1999) also found majority of cysts in the livers of ruminants. Nevertheless Mehrabani *et al*. (1999) found lungs of sheep and goats to be more infected than the livers. The intensity of hydatid cyst found by Hayat *et al*. (1986a) in sheep ranged between 1-17. Iqbal *et al*. (1989) categorized intensity in mild, moderate and extensive depending upon area of organ discarded due to hydatidosis. It was mild when one fourth of liver was condemned; moderate when half the organ was condemned and extensive when the whole organ was condemned. This way, they found mild, moderate and extensive infection in sheep and goat livers to be 52, 30, 18% and 62, 25, 13% respectively. Sheep lungs had 53% moderate, while 47% extensive infection. Goat lungs had 34, 35 and 31% mild, moderate and extensive infection respectively. Iqbal *et al*. (1989) found infection to be weak in lungs of 76% teddy goats of Faisalabad. In 20% infection was medium and in 5% it was high.

Fertility ratio of hydatid cysts

Overall prevalence of fertile, viable and nonviable hydatid cysts in sheep and goat livers was 66.46, 15.72 and 17.80%; and 52.17, 17.39 and 30.43%, respectively (Table I). Sheep and goat lungs, on the other hand, had 95.29 and 58.82% fertile, 3.52 and 41.17% viable and 1.17 and 0% nonviable hydatid cysts. Hence, fertile hydatid cysts were predominant in our study. However, in livers of sheep and goats nonviable hydatid cysts were more predominant than viable cysts. The reverse is true about lungs. Anwar *et al*. (1993) found high fertility ratio in sheep and goats. The fertility ratios were 80.95% (81.62% in lungs, 78.92% in liver) in sheep and 65.48% (69.53% in lungs, 55.96% in liver) in goats. Larrieu *et al*. (2001) studied that 63.8% of parasitized sheep presented viable hydatid cysts, 53.3% of which included fertile cysts. Gordo and Bandera (1998) observed over 80% viability of

Table I.- Overall prevalence, intensity and fertility ratio of hydatid cysts between August 2001 to March 2002.

	No. of organs examined	Hydatid cyst infection		Intensity Mean (Range)	Fertile cysts (%)	Viable cysts (%)	Nonviable cysts (%)
		Number	Percent				
Sheep liver	261	122	46.74	4 (1-28)	66.46	15.72	17.80
Goat liver	43	17	23.28	2 (1-6)	52.17	17.39	30.43
Sheep lungs	236	41	17.37	2 (1-9)	95.29	3.52	1.17
Goat lungs	95	13	13.68	1 (1-2)	58.82	41.17	

hydatid cysts in sheep of Spain. But horses of the same area showed a different picture with very low fertility ratio of hydatid cyst. It was discussed to be due to infection of horses with metacestode of sheep strain, which do not develop into fertile cysts in horse (McManus and Smyth, 1986; Bowles and McManus, 1993; Bowles *et al*., 1995; Thompson and Lymbery, 1996; Scott *et al*., 1997).

It is evident that knowledge of the existence and extent of strain variation is essential if hydatidosis is to be controlled (Thompson, 1986). The phenomenon of strain variation is an important consideration in the future design and development of vaccines, diagnostic reagents and drugs effective against the *Echinococcus* organism (Bowles and McManus, 1993). Pakistan seems to be a country having many strains, since hydatidosis is common in a number of domestic and wild animals such as sheep, goats, cattle, buffaloes, camels and wild boars (Anwar and Munir, 1980; Munir *et al*., 1982; Hayat *et al*., 1986; Iqbal *et al*., 1986a,b, 1989, 1995; Anwar *et al*., 1993). In addition hospital records (Salahuddin, 1995; Majid *et al.*, 1997; Akhtar *et al.*, 1998; Husen *et al*., 1998; Khan and Zaman, 2001; Naimat Ullah and Yousaf, 2001; Shah, 2001) and serological surveys of general population (Khan *et al.*, 1999) have also shown high incidence of hydatidosis in man, referring to the possibility of existence of human strain in the country. A study regarding strain variation of *Echinococcus* and other parasites is needed to be done based upon PCR (Polymerase chain reaction) and PCR-RFLP (Polymerase chain reaction-restriction Fragment length polymorphism) techniques. It is important that such studies are carried out, as genetic diversity may reflect differences in infectivity, especially to humans with important implications for the epidemiology of hydatid disease (Bowles and McMauns, 1993).

Different factors responsible for the epidemiology of hydatidosis

The variance of data within different areas of a country is usually seen. As in Spain, Gordo and Bandera (1998) reported that infection varies between 5-80%. Accordingly, this variance depended upon origin of sheep. Moreover, other factors as control programmes and strategies also effect hydatidosis. An interesting situation was discussed by Larrieu *et al*. (2001), who studied hydatid control programme during 1980-1999 in the province of Rio Negro, Argentina, where they found that in sheep 81 % prevalence level fell to 18.3% by the end of 20th years. Todorov and Boeva (1999) observed in Bulgaria the decline and rise in hydatidosis in human, sheep and dogs over three periods spanning 46 years. The different percentage infection seen by them were 41 % in 1965-70, which decreased to 18% in 1972. However, increase was seen during 1981-85 and 1986-1991 to be 24 and 30%, respectively. The factor responsible for this decline and rise was discussed to be control strategies of the government.

A number of factors such as, extrinsic, socio-ecological and intrinsic factors have been discussed by Gemmell and Lawson (1986) to influence the domestic life cycle of taeniidae. Among extrinsic factors were environmental temperature, environmental humidity and agents to disperse eggs, from faeces into environment. Thompson (1987) suggested blowflies as a source of spreading *E. granulosus* eggs from dog's faeces to large areas. Among socio-ecological factors were farming practices, feeding behavior of domestic definitive and intermediate hosts, legislation and meat inspection etc., level of awareness of human population, dietary preferences of human population and level of hygiene of human population. Among intrinsic factors were biotic potential of parasite and

innate and acquired resistance to infection by host. *E. granulosus* differs from *E. multilocularis* in some important epidemiological aspects such as; its lifecycle runs in domestic animals, while the later one's in wild animals; its basal reproductive rate; maturity period of the larva; and most importantly the reproductive rate of the hosts.

Hydatidosis in human population is due to a number of other factors (ethnic/cultural factors, occupational factors, economic variables and husbandry practices and beliefs) (Schwabe, 1986). In the same literature it was discussed in reference to several workers that the status of *E. granulosus* got changed in some countries (Kuwait, Japan, Uganda, the United States) due to introduction or movement of livestock. One of the best instance of introduction and spread of *E. granulosus* is studied by Crellin *et al*. (1982). According to these workers, *E. granulosus* that got introduced from Australia via dogs (ref. in Crellin *et al*., 1982), resulted in spread in central Utah. Such factors as use of local people as herders played important role in prevalence of parasite in local human population. Transport of animals resulted in spread of parasite to some of the adjoining areas. The sheepdogs that move along sheep herds pass *E. granulosus* eggs all their way in faeces, hence causing pasture contamination. Schantz (1977) found that the local Indian tribesmen in Arizona and New Mexico had close contacts with dogs. In addition the dogs were fed uncooked meat. Eckert *et al*. (2000) has done a more critical discussion of factors actually or potentially contributing to persistence or emergence of alveolar and cystic echinococcosis. Accordingly, important factors in persistence and reemergence of *E. granulosus* are presence of large number of dogs with high prevalence of *E. granulosus;* easy access of dogs to livestock organs infected with *E. granulosus;* insufficient anthelminthic treatment for dogs, restricted number or lack of small municipal slaughterhouses, inefficient inspection of meat animal, inefficient facilities for destruction of infected viscera, home slaughter of livestock animal and lack of adequate health education.

The situation in Pakistan is not very different from findings of these workers. In a survey, the different socio-cultural factors observed by Iqbal *et al*. (1997) were that most people are unaware of hydatid disease, and have close contacts (especially children) with dogs. It is mostly in this age that the infection with the parasite takes place, while the symptoms appear several years later; mostly around 25 years of age (as observed by Altintas *et al*., 1999 in Turkey). Dogs are essential for shepherds to control their livestock. Illegal slaughter especially in villages, unhygienic disposal of offal and most importantly 'the practice of feeding discarded organs to dogs were discussed by Iqbal *et al*. (1997) to be common practice in Pakistan. The reason for lack of slaughterhouses was given by Mittendorf (1978) to be their being economically unsuitable in developing countries, which is the opposite of situation in developed countries. Herlich (1978) emphasized prevention of grazing field contamination for helminth control, and also use of new and stronger drugs against them. It is also necessary to know other important helminth fauna of the area where control strategies have to be taken, since some parasites induce positively the existence of other parasites. As Jenkins (1998) saw one instance of survival of *E. granulosus* worms in a dog despite drug dosage. That dog also carried another cestode *(Spirometra erinace)* that needs higher dosage of the same drug. Presence of this parasite was considered a reason for the survival of the sixty *E. granulosus* worms in the intestine of host.

The life cyc1e of *E. granulosus* may involve sheep, cattle, pigs, goats, camels, buffaloes or horses (Gemmell and Lawson, 1986), but there are situations where *E. granulosus* occurs naturally without involving domestic animals. Such a situation was discussed by Thompson (1987) in western Australia, where 0.2% endemicity in sheep and 1% in cattle suggested that the area might be of low endemicity. Nevertheless, due to involvement of dingo-kangaroo life cyc1e a high prevalence was seen in kangaroos and feral pigs. Jenkins and Thompson (1995) by experimentally infecting wild rabbit in laboratory also suggested that they might play important role in epidemiology.

To conclude, the prevalence of hydatidosis in lungs and livers of sheep and goats in Quetta is high. Moreover, high intensity of cysts and their fertility ratio in sheep suggest the predominance of sheep strain in the country.

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