

# RETROSPECTIVE STUDY ON HUMAN CYSTIC ECHINOCOCCOSIS IN SOUTH DARFUR STATE, WESTERN SUDAN

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Cystic-echinococcosis(CE) caused by larval stage of *Echinococcus* species is a serious parasitic infection, and in accident cases human beings may get infected by uptake of egg and this may lead to a very serious disease in human beings especially respiratory involvement. CE especially that caused by *E. granulosus* is considered as major zoonoses affecting ruminant animals and result in paramount economic loss in meat production. The current retrospective survey was performed to determine the prevalence, distribution and intensity of *Echinococcus granulosus* in human of South Darfur State, one of endemic areas for CE in Sudan. Results obtained from surgical data records indicated presence of only one case of liver hydatidosis at Addein hospital. While diagnostic CT data records revealed the overall prevalence rate of 1.22% of CE. The high infection rate was recorded for liver infection. The rate of infection was significantly higher in female than in male and rural areas had higher prevalence rate than the urban ones. The study documented the prevalence of human hydatidosis in the study area for the first time.

**Keywords:** Cystic echinococcosis, Human CT, South Darfur, Sudan.

## INTRODUCTION

The Cestodal *Echinococcus granulosus* (*E. granulosus*) is the agent of hydatid disease, one of the major zoonoses affecting man as well as wild animals and his domestic and pet animals (Dopchiz, *et al.*, 2009). The disease that is caused by the larval stages of the parasites, hydatidosis, or adult parasite, echinococcosis, has a global distribution but is particularly prevailing in rural areas (Torgerson and Budke, 2003 and Mirzanejad-Asl, *et al.*, 2010). In the Sudan, since the first record of human hydatidosis in six cases by Christopherson in 1909, many researchers have reported human echinococcosis prevalent in the Sudan (Tola, 1987; Elmahdi *et al.*, 2004; Omer, *et al.*, 2004; Ahmed and Aradaib, 2006; Ahmed *et al.*, 2007; Ahmed, 2010; Omer *et al.*, 2010 and Ahmed *et al.*, 2011). In South Darfur State, Omer *et al.* (2010) reported on occurrence of G6 genotype of *Echinococcus granulosus* in one human isolate originated from Nyala. Information on the epidemiology of the disease in the study area is very scarce. The study aims to determine the prevalence, distribution and intensity of *Echinococcus granulosus* in human of South Darfur State.

## MATERIAL AND METHODS

### Study area:

The study conducted in South Darfur State, a known endemic area for CE in sub-Saharan region in Sudan. The State lies between latitude 8° and 14° North and longitude 22° and 28° East at far South west of the Sudan (Fig. 1.). Its

northwestern border is occupied by Gebal Marr which is a mountainous area about 6000 Feet above sea level. Bahr El Arab River comprises the southern border of the state. The state occupies 87137 square kilometers. Rainfall starts in May or June to October results in seasonal swamps or seasonal rivers. The climate in this state is savannah type with clay sandy and stone soil in the south, whilst the north is semi-desert with sandy soil. The climate is characterized by a Hot wet season (June-October), Cool dry season (November-February) and Hot dry season (March-May). According to meteorological annual data from Nyala Airport Meteorological Station, the mean minimum and maximum temperatures were 20.98 °C and 35.14 °C respectively. The annual relative humidity and total rainfall were 35.58% and 402.49 ml, respectively. The human population is about 4,093,594 comprising 10% of Sudan population (Obtained from Bureau Statistic Office of South Darfur State). Eighty percent of people in the state work in mixed crop-livestock form of agriculture (Fig. 2). The state represent the most heavily populated Sudan region by livestock which spread in its all parts. The total number of livestock is about 12550434 animals. Out of these 3548022 sheep, 2519445 goats, 3476518 cattle, 6449 camels, and 3000000 equines, beside a considerable number of other domestic animals (Tahir, *et al.*, 2006). The agro-p pastoral activity depends on nomadic system (Fig. 3). South Darfur of Sudan is characterized by its national park (Fauna of Radom National Park), where the wild life survived here include elephant, giraffe, hippopotamus, buffalo, giant eland, roan antelope, tiang, waterbuck, reed buck, kob, bush buck, oribi, duikers, red-fronted gazelle, warthog, black-backed jackal, fox, hyaena, lion, leopard, wild dog, patas monkey, baboon and ostrich (Wilson, 1979). Malek (2002) stated that, civil war has a negative impact on wildlife , as some species might have moved to the neighboring countries to a void the disturbance. Therefore, the present status of wildlife in these regions is unknown because of civil war in the study area.

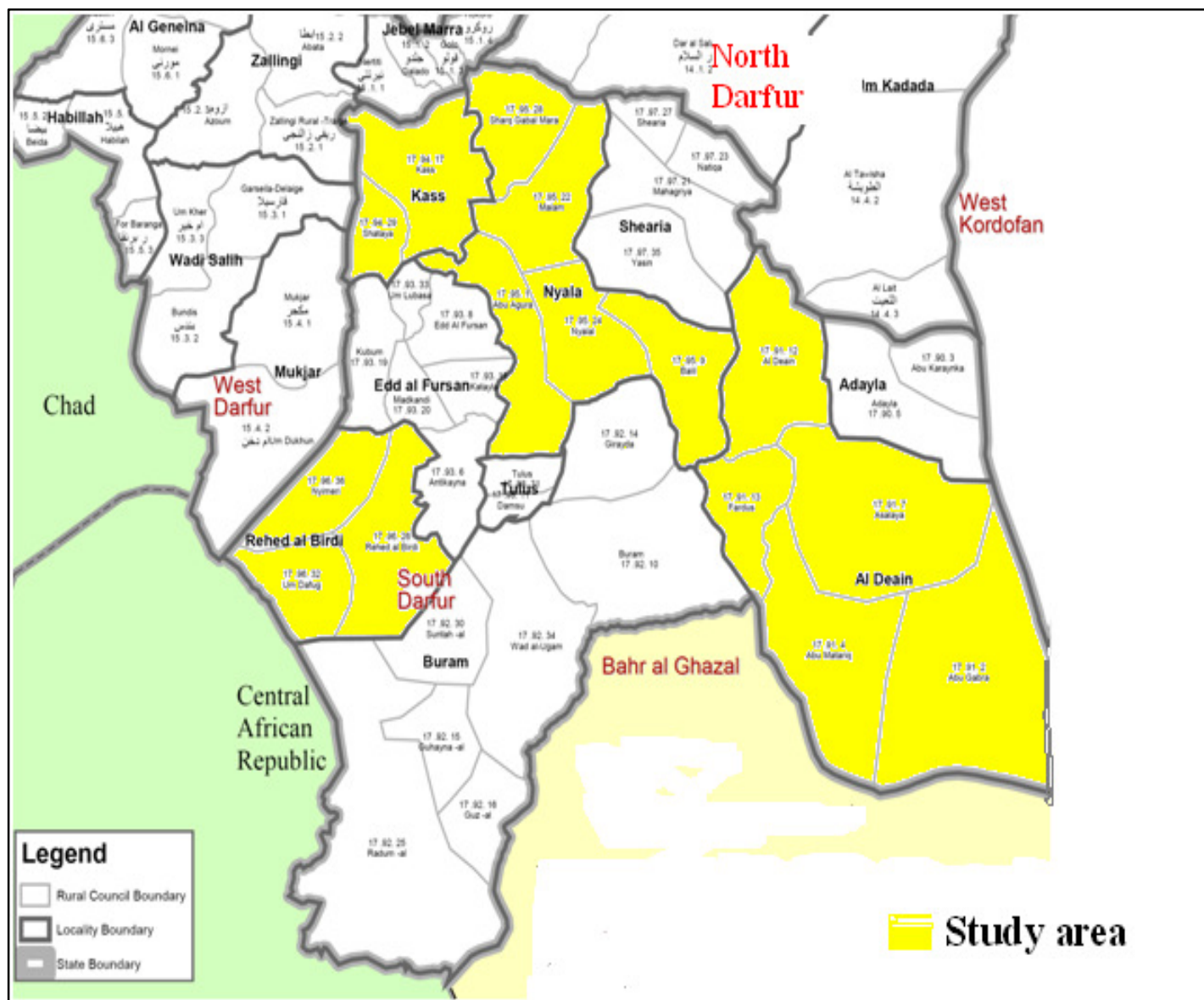


Fig. 1. The map of study area.



State. As a preliminary procedure, letters sent to authorities in these places to ask for permission for such retrospective survey to be carried out. This followed by personal visits to these mentioned units. The survey covers a 2-year period (2012-2014). During this time, each case was given a serial number accompanied by recording of gender, age and detectable clinical symptoms. Each case was subjected to the appropriate diagnostic procedures during clinical and laboratory investigations. The definitive diagnosis based on clinical and CT. The survey included hospital records on surgical incidence of cystic hydatid disease in Nyala, Addein, Rehed al Birdi and Kass teaching hospitals, beside diagnostic records in Alhag Atta Al Mannan diagnostic center, Nyala were used to determine the prevalence of CE in human. Collected data finally tabulated and the prevalence of the parasite for different species were calculated. Epidemiological data managed by SPSS computer programme (Microsoft version No. 20, USA). Data analyzed using frequencies, one sample t-test and correlation coefficient.. The level of significance was taken at ( $P < 0.05, 0.01$ ).

## RESULTS

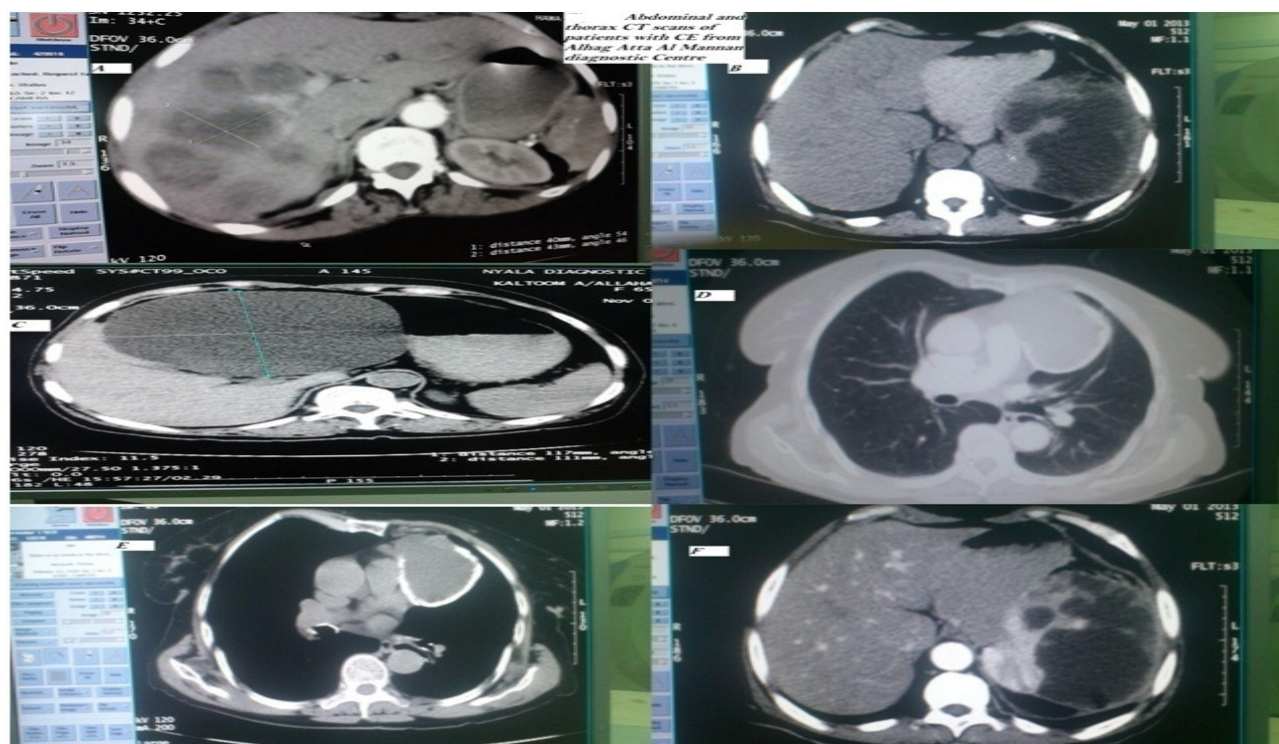
### The prospective and retrospective survey

A retrospective study represents the data of surgical records at Statistics and Information Unit of Nyala, Kass, Addein and Rehed al Birdi hospitals was conducted during the period of 2012 to 2014. The study indicated to only one case of liver hydatidosis at Addein hospital. On the other hand, the data of retrospective study collected from diagnostic CT records of Alhag Atta Al Mannan diagnostic centre, Nyala during that period revealed the overall prevalence rate of 1.22% (Table. 1 and Fig. 4).

**Table. 1.** Prevalence of cystic echinococcosis in South Darfur State according to diagnostic CT records of Alhag Atta Al Mannan diagnostic centre, Nyala

Variables	Number examined of CT	Number positive	Prevalence (%)
Male	307	2	0.65%
Female	265	5	1.89%
Total	572	7	1.22%

In addition to that, all the positive cases recorded were over 27 years old whereas, most of the cyst discovered was multiple cysts (57.1%). However, the mean size of the cysts recorded was  $29.87 \pm 18.89$  cm (Mean  $\pm$  SD). Among the positive cases, rate of infection was significantly higher in female (71.4%) than in male (28.6%), while the rural area had higher prevalence rate (71.4%) than the urban area (Fig. 5 and 6). Although there was no negative or positive correlation between the number of cases and sites of cyst, the high infection rate was recorded in the liver (57.1%) fig. (7).



**Fig. 4.** A and C - Abdominal computed tomography showed hepatic cystic echinococcosis, B and F - Abdominal computed tomography showed splenic cystic echinococcosis, D- Thorax computed tomography showed a lung cystic echinococcosis, E- Thorax computed tomography showed a pericardiac cystic echinococcosis

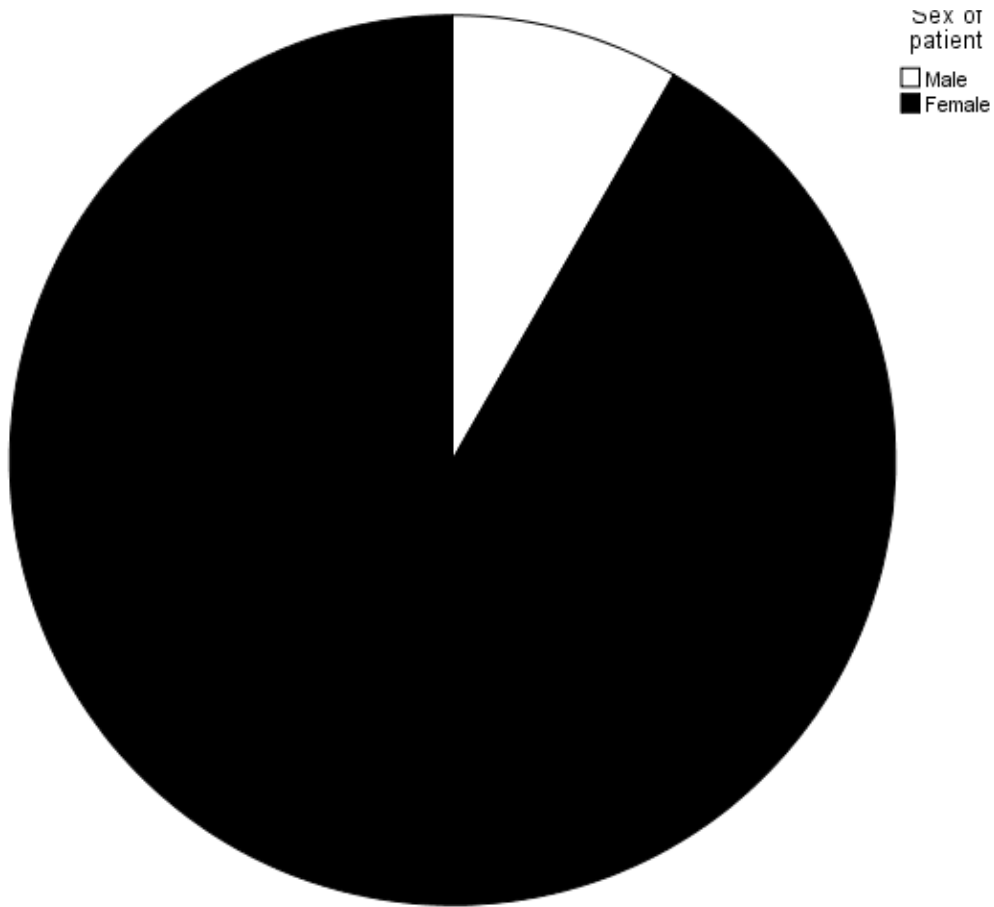


Fig. 5. Prevalence of human hydatidosis in male and female in South Darfur State

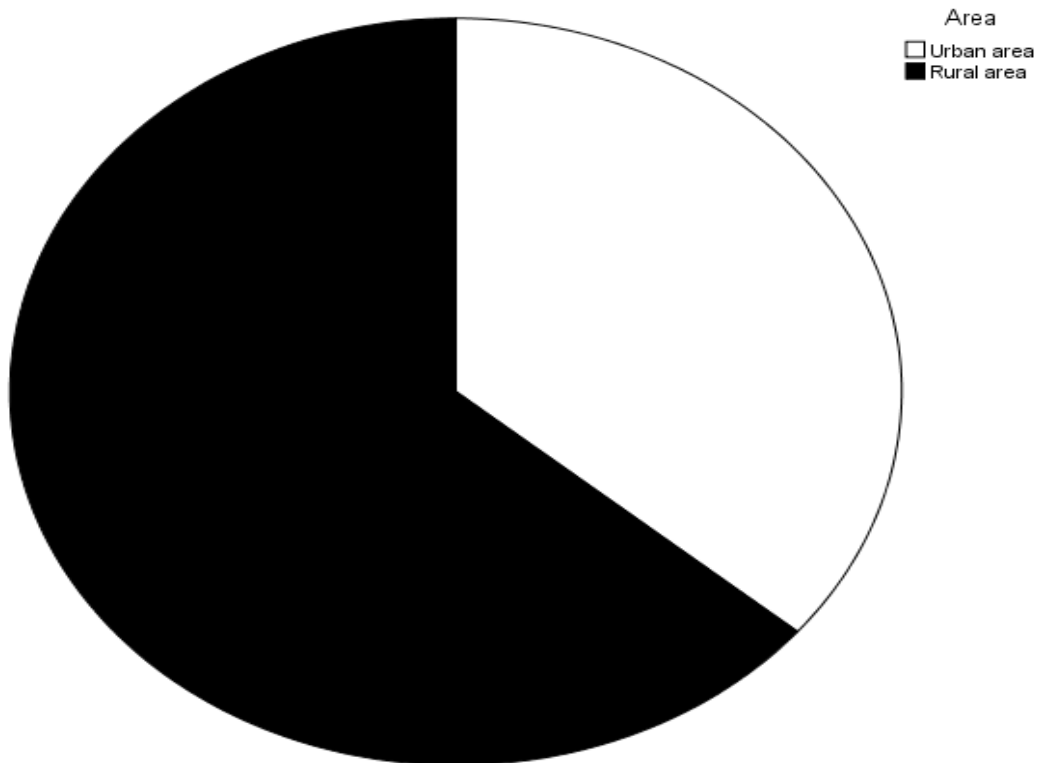


Fig. 6. Prevalence of human hydatidosis in rural and urban areas of South Darfur State

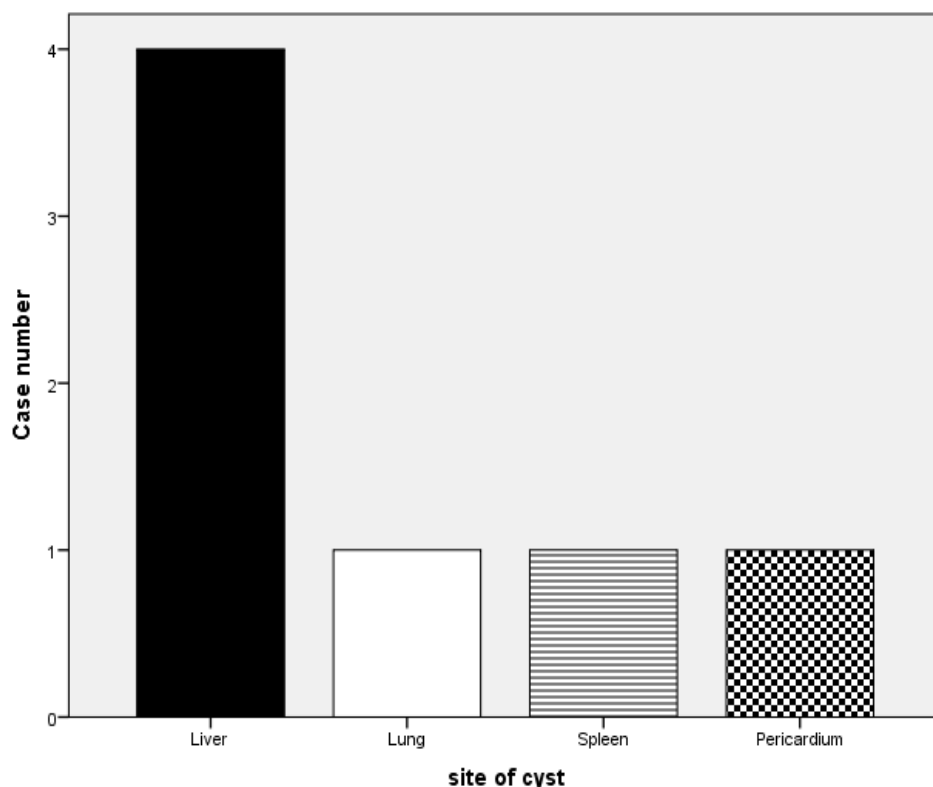


Fig. 7. The infection rates of human hydatidosis within the organ of the body in South Darfur State

## DISCUSSION

Cystic echinococcosis is highly endemic in sub-Saharan Africa including Ethiopia, Kenya, Mauritania, Sudan, and Tanzania (Romig *et al.*, 2011 and Magambo *et al.*, 2006). In Sudan several studies documented the endemicity of human cystic echinococcosis in different parts of the country (Tola, 1987; Elmahdi *et al.*, 2004; Ahmed *et al.*, 2007; Ahmed, 2010; Omer *et al.*, 2010 and Ahmed *et al.*, 2011). The infection with hydatidosis in humans happens by accident either by direct ingestion of eggs due to close proximity with affected dogs or by indirect means from food or water sources. In the present retrospective study, only one case of human liver hydatidosis was documented in Addein hospital surgical records, beside seven cases in diagnostic CT records of Alhag Atta Al Mannan diagnostic centre, Nyala with overall prevalence of 1.22%. These findings in contrast with Mohammed (1997) who stated that human hydatidosis was not documented in Nyala area as consequence of lack of good diagnostic facilities or inefficient disease-recording systems. The prevalence rate in this study is higher than that reported by Elmahdi, *et al.* (2004) in central Sudan (0.33%), this may be due to the variation in diagnostic methods, where they used ultrasound in limited area and the number of subjects examined was relatively small. Also results of this study indicated that, all the positive cases recorded were over 27 years old. This finding agrees with that reported by Omer *et al.* (2010). Furthermore, the study indicated that the rural areas had significantly higher prevalence rate than the urban areas. This could be related to depending of rural peoples on animals for food, transportation, and farm work, beside large numbers of dogs in and around villages, unsupervised home slaughtering and lack of hygiene. Moreover, the results of the present study found that the prevalence rate of human infection was significantly higher in female than male and that is in agreement with reports from French, *et al.* (1982), Schneider, *et al.* (2010); Omer *et al.* (2010) and Zhang *et al.* (2015). This could be attributed to the fact that the society depend on women in water collection and home services such as cleaning and care of animals particularly in rural areas. Contrary to that found by Ahmed *et al.* (2007) and Omer *et al.* (2010), the high infection rate in this study was recorded in liver. These findings are in agreement with several works (French, *et al.*, 1982; Ito, *et al.*, 1998; Eckert, *et al.*, 2000; Ito, *et al.*, 2007 and Schneider *et al.*, 2010).

## CONCLUSION

The present study documented for the first time human hydatidosis, but other surveys for human hydatidosis using high scanning techniques and serological tests, beside molecular surveys of *Echinococcus granulosus* genotypes in the

study area are needed.

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