Global Veterinaria 11 (6): 753-758, 2013
ISSN 1992-6197

DOI: 10.5829/idosi.gv.2013.11.6.76139

Cystic Echinococcosis in Small Ruminants in Tiaret (Algeria)

[1]Kouidri Mokhtaria, [1]Benchaib-Khoudja Fatima,
[1]Boulkaboul Abboud and [1,2]Selles Sidi Mohammed Ammar

[1]Institute of Veterinary Science,
Ibn-khaldoun University of Tiaret, Tiaret 14000, Algeria
[2]Laboratory of Research on Local Animal Products,
Ibn-Khaldoun University of Tiaret, Tiaret 14000, Algeria

Abstract: The present study was designed to determine the prevalence of cystic hydatidosis in sheep and goats in Tiaret Abattoir (Algeria), estimate the fertility of hydatid cysts and viability of protoscoleces and define seasonal incidence of hydatidosis in sheep. Of 3557 sheep and 2375 goats examined, 247 carcasses of sheep and 37 of goats harbored the cysts, representing infection rates of 6.94% and 1.56%, respectively ($P<0.005$). The prevalence of hydatid cysts was significantly higher in sheep and goats of age equal to three years or less. In both sheep and goats, the rate infection of hydatidosis was significantly higher in female than male ($P<0.005$). In sheep, the rate of co- infection (liver and lungs) was higher. In goats, lungs were the most infected. The global fertility rate of the cysts in sheep was significantly greater in sheep than in goats with 67% and 5% respectively. The viability of protoscoleces of fertile cysts was higher in both sheep and goats. It can be concluded that the sheep play greater role in dissemination of the disease and contamination of human in our region. The differences between the prevalence rate and fertility of hydatid cysts in sheep and goats were probably due to different genotypes of *Echinococcus granulosis*.

Key words: Hydatidosis · Small Ruminants · Prevalence · Protoscleces · Algeria

INTRODUCTION

Cystic echinococcosis (CE) is a zoonotic disease caused by larval stage of the tape worm, genus Echinococcus [1]. Definitive hosts are carnivores such as dogs and the intermediate hosts are herbivores and omnivores wherein the development of the cysts occurs in liver, lungs and other organs [2]. The pathogenecity of hydatidosis heavily depends on the extent and severity of infection and the organ which it is located [3].

Echinococcus granulosis (*E. granulosis*), which is found in the small intestines of dogs [2], is very present in Algeria with prevalence ranging from 9 to 41% [4].

Cystic hydatid, is a worldwide distributed disease and is prevalent mostly in Mediterranean countries [5]. It remains highly endemic in North Africa and represents a serious public health problem [6] especially in the rural communities where the dog lives in close quarters with man and domestic herbivores, feeding on scraps and offal of wild herbivores [7]. Ultrasound surveys of populations at risk have shown that CE is more prevalent than previously anticipated in many endemic regions [8]. In Algeria, the mean annual incidence rate varied from 3.4 to 4.6 cases/100000 habitants [9]. The infection also leads to economic losses due to the condemnation of livers and to lowered meat and milk production [10].

The fertility of hydatid cysts is one of the important factors in the epidemiology of *E. granulosis* and in human it is an essential element for the process of formation of secondary hydatidosis [11]. It varies depending on the intermediate hosts and geographical situation [12, 13] and therefore control measures and control programs must be appropriate for each region [14].

Hence, this study aims to determine the prevalence of hydatidosis, the fertility, the viability of hydatid cysts of sheep and goats slaughtered at Tiaret Abattoir (Algeria) and define seasonal incidence of hydatidosis in sheep.

Corresponding Author: Kouidri Mokhtaria, Institute of veterinary science,
Ibn-Khaldoun University of Tiaret, Tiaret 14000, Algeria.
Tel: +213-772-157-150, Fax: + 213 46 42 71 61.

MATERIALS AND METHODS

Study Area: The present study was conducted in Tiaret Abattoir and parasitological laboratory of the University of Tiaret Algeria. The region is situated in the high plateau of Algeria, a semi-arid area characterized by cold and humid winter and hot and dry summer.

Post Mortem Examination of Slaughtered Animals: The study was conducted in two periods; from April to December 2010 and from September 2011 to 2012. It was carried out on 5932 animals (3557 sheep and 2375 goats). During the study, the slaughterhouse was visited periodically to examine the organs of slaughtered animals for the presence of *CE*. It comprises both sexes and all age groups. Age was determined based on the dentition and owner's information.

The seasonal distribution of hydatid infestation rate of hydatidosis was performed during retrospective study that involved 2009 and was based on statistical data recorded by month in the slaughterhouse. This section only applies to the sheep, given the large number of cases of hydatid disease compared to goats.

Examination of Cysts: 200 cysts from sheep (100 from liver and 100 from lungs) and 19 cysts from goats (6 from liver and 13 from lungs) were grossly examined for degeneration and calcification. The cyst wall was penetrated with scalpel and scissors. The contents were transferred into a sterile container and examined microscopically (10x) for the presence of protoscoleces. Cysts which contained no protoscoleces as well as heavily suppurative or calcified were considered unfertile [15].

The viability of protoscoleces was assessed by morphology, movement and presence of flame cells and, when necessary, by neutral red viable staining [16]. The viability of protoscoleces was carried out on for each fertile cyst per animal species and organ. For clear vision, a drop of 0.1% aqueous eosin solution was added to an equal volume of protoscolices in hydatid fluid on microscope slide, with the principal that viable protoscolices should completely or partially exclude the dye while the dead ones take it up [17].

Statistical Analysis: Statistical tests were performed using Statistical tests (Student test) to compare prevalence, location, rate of fertility and viability of hydatid cysts in sheep and goats and seasonal incidence in sheep during the year 2009.

Table 1: Prevalence of hydatid cysts in sheep and gots slaughtered in the Tiaret abattoir.

Animals	Examined animals	Infected animals
sheep	3557	247 (6.94%)*
Goat	2375	37 (1.56%)*

Table 2: Sex distribution of animals infected with hydatidosis.

Animals	Prevalence of male	Prevalence of female
Sheep	1.36% (26/1907)	13.39% (221/1650)*
Goat	0.58% (7/1215)	2.56% (30/1160)*

Table 3: Prevalence of hydatidosis in sheep and goats in different age groups

	Prevalence	
Age (years)	Sheep	Goats
<1	1% (3/247)	13.51% (5/37)
1-2	3% (8/247)	29.73% (11/37)
2-3	11% (26/247)	16.22% (6/37)
>3	85% (210/247)*	40.54% (15/37)*

Table 4: The location of the cysts in the organs of the infected animals.

Location	Sheep	Goats
Liver only	29.55%	21.62%
Lungs only	34.41%	56.76%*
Co-infection (liver+ lungs)	35.36*	21.26%
kidney	0.4%	0%

RESULTS

Out of 3557 sheep and 2375 goats slaughtered at the Tiaret Abattoir, 247 sheep (6.94%) and 37 goats (1.56%) were found harboring one or more hydatid cyst.

The prevalence was higher in sheep compared to goats ($P<0.005$) Table 1.

In both sheep and goats, the incidence of hydatid disease observed in female Animals were higher than male animals. There was a statistically significant difference between the two sexes ($P<0.005$) Table 2.

During the current study, the higher prevalence was recorded in adult sheep and goats as compared to younger ($P<0.005$) Table 3.

As regarded to the organ involvement, Table 4 reveals that in sheep co-infection of the liver and lungs was most commonly. In goats, the prevalence of CE only in lungs was the most commonly.

The fertility rate of cysts and the viability of protoscoleces from fertile cyst in lungs or livers of sheep and goats are shown in table 5. The cysts recovered from liver and lungs of sheep showed higher fertility rates: 69% in lungs and 65% in liver only 0% and 7.69% in liver and lungs of goats, respectively. The global fertility rates of infected sheep and goats were 67% and 5%, respectively ($P<0.005$). The rate of viability of all fertile cysts was higher in both sheep and goats as shown in Table 5.

Table 5: Fertility of hydatid cysts and viability of protoscoleces of fertile cysts recovered from liver and lungs of slaughtered sheep and goats

Species	Infected organs	Number of examined cysts	Rate of fertility	Rate of viabile protoscoleces in fertile cysts
Sheep	Liver	100	65%	89%
	Lungs	100	69%	85%
	Total	200	67%*	87.37%
Goats	Liver	6	0%	0%
	Lungs	13	7.69%	100%
	Total	19	5%*	100%

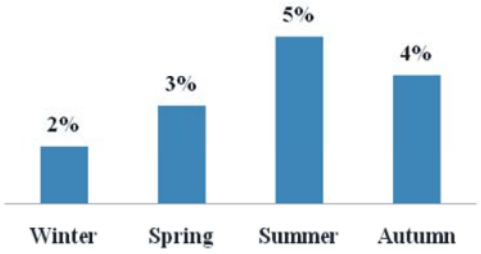

Fig. 1: Seasonal incidence of hydatidosis in slaughtered sheep during 2009.

During the year 2009, of the 7385 sheep slaughtered 263 (4%) were found harbored hydatid cyst.

The highest incidence of hydatid cyst was found in summer (5%), followed by autumn (4%). The lowest was noticed in winter (2%). These seasonal variations were statistically significant (P<0.005) (Fig. 1).

DISCUSSION

Inspection records of slaughtered animals have been used as useful sources for evaluation of the epidemiological aspect of certain diseases in several countries [18] and in some cases (cysticercosis and echinococcosis), postmortem examination is one of the best way to confirm some parasitic disease with discrete pathology [19].

In the current study, the incidence of hydatidosis of sheep was 6.94%. Similar results were reported 5.9% in Mauritania and 7.37% in Rif mountains of Morocco by Ould Ahmed Salem [2] and Azlaf and Dakkak [20], respectively.

Lower prevalence rates were reported 0.66% [21], 2% [22], 3.21% [23]. In the same region of study, a rate of 3.8% was noted by Kouidri *et al* [24], which mean clearly that this zoonotic disease (CE) is an increasing problem in Tiaret region.

Higher prevalence among sheep were reported 11.6% [25], 13.5% [5], 14.7% [26] and 16.42% [6].

In the present study, the infection rate of goats of 1.56% could be classified as low. Similar rate was reported 1.7% in Ethiopia [27].

Lower prevalence rates were reported; 0% in Loukkos (Morroco) [20] and 0.52% [22]. Higher prevalence among goats were reported; 6.13% [28] and variables rates ranging from 16.1% to 20% in Iran [29].

Our findings showed that sheep were found to be more commonly infected with hydatid cysts compared to goats (P<0.005). Several studies were reported the same situation [29-32]. In goats, the smaller number of hydatid cysts per infection may be due to the fact that they are browsers rather than grazers and ingest a small number of viable eggs or to a possible protective immunity in this animal species. These epidemiological findings would also suggest that the sheep strain is not adapted to goats [20].

In the current study, females were more likely to have CE infection than males (P<0.005) in both sheep and goats examined. Females are more susceptible to the infection by metacestode of *E. granulosis*, than the males and the parasite may cause hormonal imbalance, especially in testosterone and estradol in chronic stages, being able to remain for long periods in its host [33]. Females are most affected because they live longer than males [6, 17]. Furthermore, the reasons may be the longer age of females at the time of slaughtering and the stress of pregnancy, parturition and lactation [34].

In the current study, a significant variation was observed in the rates of infection between age groups where animals above 3 years of age were highly infected; which confirm the results reported by Azlaf and Dakkak [20] and Lahmar *et al*. [6]. This could be mainly due to the fact that aged animals have longer exposure times to eggs of *E. granulosis*, in addition to weaker immunity to combat against the infection [32]. The chances of detecting cysts at meat inspection are higher in aged animals due to the bigger size of the cyst [23].

Livers and lungs were the most frequently infected visceral organ examined. This is explained by the fact that livers and lungs possess the first great capillaries sites encountered by the migrating echinococcus oncosphere (hexacanth embryo) which adopt the portal vein route and primarily negotiate hepatic and pulmonary filtering system sequentially before any other peripheral organ is involved [3]. However, development of hydatid cysts occurs occasionally in other organs and tissue when oncosphere escape into the general systemic circulation [35].

In sheep, the highest distribution was in co-infection (liver and lungs). The finding is in agreement with the findings of Giannetto *et al*. [36], Azzlaf and Dakkak [20]

and Kouidri *et al*. [24]. In goats, from the organ prevalence study the lung is found to be the most commonly affected organ followed by liver. This was also the results reported by Sangaran and Lalitha [37] and Getachew *et al*. [28].

The fertility rate of the cyst by no means is of great importance in epidemiological studies, not only to the possibility of fertile cysts to disseminate the disease but also to define the probable function of each species as a potential host in the spread of the infection [22]. Regarding the fertility of hydatid cysts in small ruminants examined, the cysts collected from sheep are more fertile than those of goats origin ($P<0.005$). Jarjees and Albakri [22] have reported same observation. These findings would also suggest that the sheep strain is not adapted to goats [20].

The current research revealed that in sheep, the fertility of pulmonary cysts (69%) was higher than those of hepatic cysts (65%). These results were in agreement with those reported by Scala *et al*. [16]; Alemian *et al*. [38]; Daryani *et al*. [15] and Getachew *et al*. [28]. Khan *et al*. [39] reported that in sheep the fertility of cysts in the liver was similar to that of the cysts in the lungs. Variation in fertility rate among the organs might be due to the difference in tissue resistance among of the organs [28].

In goats, the results relating to fertility rates indicated less importance of this animal species.

Seasonal prevalence was recorded in sheep, it was statistically different during all the four seasons ($P<0.005$) of the year 2009. Seasonal analysis showed the highest prevalence in summer and the lowest prevalence of infection in winter (5% and 2%, respectively). These results were in agreement with those reported by Ahmadi and Meshkehkar [40], Surhio *et al*. [41] and Iqbal *et al*. [34].

This significant seasonal variation for prevalence may be due to changes in management practices and ecological factors [42].

From the epidemiological point of view, it can be concluded that sheep play an important role in perpetuating and dissemination of the disease due to their high infection rates and fertility. Goats do not seem to be very important in transmission dynamics as the majority of cysts removed from goats were sterile. The increasing rate of hydatidosis in the study area is challenges to all professionals concerned with public health.

The present survey provides preliminary baseline data for the future monitoring of this potentially important parasitic disease and justifies a program of hydatidosis control in the area that involves more effective measures to control the stray dog population and the safe disposal of infected offal.

ACKNOWLEDGMENTS

This work was financially supported by project PNR: 4218, INRAA 2011, Institute of Veterinary Sciences, University Ibn-Khaldoun (Tiaret), Algeria.

The authors would like to express their special thanks to the staff members of Tiaret municipal abattoir for all sorts of assistance and management for allowing us to conduct post mortem inspection on visceral organs of sheep and goats, especially; Dr Khattab, Dr Bourbiaa, Dr Chehbi, Dr Cherfaoui and Dr Meghazi.

REFERENCES

1. Endalew, D. and I. Nurradis, 2013. Prevalence and Economic Importance of Hydatidosis in Cattle Slaughtered at North Gonder Elfora Abattoir. Eur. J. Appl. Sci., 5: 29-35.
2. Ould Ahmed Salem, C.B., F. Schneegans, J.Y. Chollet and M.H. Jemli, 2010. Prevalence and aspects of lesions of hydatidosis in camel in Northern Mauritania. Revue. Elev. Méd. Vét. Pays trop., 63: 23-28.
3. Kebede, W., A. Hagos, Z. Girna and F. Lobago, 2009. Echinococcosis/hydatidosis: Its prevalence, economic and public health significance in Tigray region. Trop. Anim. Heallth. Prod., 41: 865-871.
4. Bentounsi, B., S. Meradi, A. Ayachi and J. Cabaret, 2009. Cestodes of untreated large stray dog populations in Algeria: A reservoir of herbivore and human parasitic diseases. Open. Vet. Sci. J., 3: 64-67.
5. Fikire, Z., T. Tolosa, Z. Nigussie, C. Macias and N. Kebede, 2012. Prevalence and characterization of hydatidosis in animals slaughtered at Addis Ababa abattoir, Ethiopia. Journal of Parasitology and Vector Biology., 4: 1-6.
6. Lahmar, S., M. Trifi, S. Ben-Naceur, T. Bouchhima, N. Lahouar, I. Lamouchi, N. Maamouri, R. Selmi, M. Dhibi and P.R Torgerson, 2012. Cystic echinococcosis in slaughtered domestic ruminnats from Tunisia. J. Helminthol., 1-8.
7. Tilahun, A. and Y. Terefe, 2013. Hydatidosis: prevalence, cyst distribution and economic significance in cattle slaughtered at Arbaminch municipality abattoir, Southern Ethiopia. Global Veterinaria., 11: 329-334.

8. Gebremichael, D., A. Feleke, G. Tesfamaryam, H. Awel and Y. Tsigab, 2013. Knoweldge, attitude and practices of Hydatidosis in Pastoral community with relation to public health risks in Ayssaita, Northeastern of Ethiopia. Global Veterinaria, 11: 272-279.
9. Kaouyeche, F., M. Chassagne, A. Benmakhlouf, D. Abriald, N. Dorr, C. Benlatreche and J. Barnouin, 2009. Socio-ecological factors associated with risk of family hydatidosis in the wilaya of Constantine (Algeria) through interviews of urban and rural households. Revue Méd Vét, 160: 119-126.
10. Torgerson, P.R., 2003. The economic effects of echinococcosis. Acta Tropica, 85: 113-118.
11. Oudni-M'rad, M., S. M'rad, M. Gorcii, M. Mekki, M. Belguith, I. Harrabi, A. Nouri, R. Azaeiz, H. Mezhoud and H. Babba, 2006. Cystic echinococcosis in children in Tunisia: Fertility and cysts location. Bull. Soc Pathol Exot., 100: 10-13.
12. Kose, M. and F. Kirakli-Sevilmi, 2008. Prevalence of cystic echinococcosis in slaughtered cattle in Afyonkarahisar. Tûrkiye. Parasitoloji. Dergisi., 32: 27-30.
13. Scala, A. and R. Mazette, 2009. Cystic echinococcosis in the sheep: causes of its persistence in Sardinia. Vet. Res. Commun., 33: 41-45.
14. Bouree, P., 2001. Hydatidosis: dynamics of transmission. World. J. Surg., 25: 4-9.
15. Daryani, A., M. Sharif and A. Amouei, 2009. Fertility and viability rates of hydatid cysts in slaughtered in the Mazandaran Province, North Iran. Trop. Anim. Health. Prod., 41: 1701-1705.
16. Scala, A., G. Garippa, A.Varcasia, V.M. Tranquillo and C. Genchi, 2006. Cystic echinococcosis in slaughtered sheep in Sardinia (Italy). Veterinary Parastology, 135: 33-38.
17. Rahmani, K., M.H. Radfar and K. Adinehbeigi, 2012. Hydatidosis: prevalence and biometrical studies in sheep in Kerman area, southeast of Iran. Comp Clin Pathol, pp: 1-6.
18. Lotfi, A., M. Yusefkhani, A. Samavatian, H. Yilmaz, Z. Tas Cengiz and M. Valilou, 2010. Prevalence of cystic echinococcosis in slaughtered sheep and goats in Ahar abattoir, Northwest part of Iran. Kafkas Univ Vet Fak Derg, 16(3): 515-518.
19. Blaise, J., 2001. Prevalence and frequency of the parasitic lesions of the ruminants liver and lungs in Haïti. Revue Méd. Vét., 152: 269-274.
20. Azlaf, R and A. Dakkak, 2006. Epidemiological study of the cystic echinococcosis in Morocco. Vet. Parasitol, 137: 83-93.
21. Abu-Elwafa, S.A., M.A. Al-Araby and I.E.A. Abbas, 2009. Metacestodes among sheep slaughtered at Mansourah Abattoir, Dakahlia Province, Egypt. Mansourah Veterinary Medical Journal, 11: 21-33.
22. Jarjees, M.T. and H.S. Al-Bakri, 2012. Incidence of hydatidosis in slaughtered livestock at Mosul, Iraq. Iraqi J. Vet. Sci., 26: 21-25.
23. Baswaid, S.H., 2007. Prevalence of hydatid cysts in slaughtered sheep and goats in Hadhramout (Yemen). Ass. Univ. Bull. Environ. Res, 10: 67-72.
24. Kouidri, M., F. Benchaib-Khoudj, A. Boulkaboul and S.M.A. Selles, 2012. Prevalence, fertility and viability of cystic echinococcosis in sheep and cattle of Algeria. Bulg J. Vet Med, 15: 191-197.
25. Desta, Y., M. Tefera and M. Bekele, 2012. Prevalence of hydatidosis of sheep slaughtered at abergelle expot abattoir, Mekelle, Northern Etiopia. Global Veterinaria, 9(4): 490-496.
26. Yousefi, M.R., M.Y. Asna Ashri and M. Mon-Tazeri, 2007. Study of hydatid cyst in slaughtered animals in Mazandaran Province, Iran. 2005-6. Quaterly Journal of Yasouj University of Medical Sciences, 12: 73.
27. Jibat, T., G. Ejeta, Y. Asfaw and A. Wudie, 2008. Causes of abattoir condemnation in apparently healthy slaughtered sheep and goats at HELMEX abattoir, Debre Zeit, Ethiopia. Revue Méd. Vét., 159: 305-311.
28. Getachew, D., A. Jizat and T. Getachew, 2012. Occurrence and fertility rates of hydatid cysts in sheep and goats slaughtered at Modjo Luna Export Slaughter House, Ethiopia, Ethiop. Vet. J., 16: 83-9.
29. Rokni, M., 2009. Echinococcosis/Hydatidosis in Iran. Iran. J. Parasitol., 4: 1-6.
30. Daryani, A., R. Alaei, R. Arab, M. Sharif, M.H. Dehghan and H. Ziaei, 2006. Prevalence of hydatid cyst in slaughtered animals in Northwest Iran. Journal of Animal and Veterinary Advances, 5, 330-334.
31. Fakhar, M. and S.M. Sadjjadi, 2007. Prevalence of Hydatidosis in Slaughtered Herbivores in Qom Province, Central Part of Iran. Vet. Res. Commun., 31: 993-997.
32. Adinehbeigi, K., M.H. Radfar, K. Rahmani, M.M. Dehaghi, M. Sami and Z. Yadegari, 2013. Abattoir survey on goats hydatidosis in Kerman area, Southeast of Iran: Prevalence and some biotic and abiotic factors. Comp Clin Pathol, 22: 461-466.
33. Blancas, M.M., E.R. Herrera, Rodreguez, J.P. Tavizn, R.M. Mercado, A.V Badillo, F. Echavarra, S.A Lopez and C. Mondragn, 2007. Gender as a factor of susceptibility to infection in experimental hydatidosis. Rev. Latinoam. Microbiol., 49: 31-37.

34. Iqbal, H.J., A. Maqbool, M. Lateef, M.A. Khan, A. Riaz, A. Mahmood, F.A. Atif, Z. Ali and M.S. Ahmad, 2012. Studies on hydatidosis in sheep and goats at Lahore, Pakistan J. Anim. Plant. Sci., 22: 894-897.
35. Abunna, F., S. Fentaye, B. Megersa and A. Regassa, 2012. Prevalence of bovine hydatidosis in Kombolcha Elfora abattoir, North Eastern Ethiopia. Open. Journal. of Animal Sciences., 2: 281-286.
36. Giannetto, S., G. Poglayan, E. Briant, C. Sorgi, G. Galio, S. Canu and A. Virga, 2004. An epidemiological updating on cystic echinococcosis in cattle and sheep in Siccily, Italy. Parassitologia., 46: 423-424.
37. Sangaran, A. and J. Lalitha, 2009. Prevalence of hydatidosis in sheep and goats in around Chennai., Taminnadu. J. Veterinary. Anim. Sci., 5: 208-210.
38. Alemian, S., G. Karimi and S. Rivaz, 2007. Fertility and viability of protoscoleces of hydatid cysts of sheep slaughtered in slaughter house of Chaharmahal-o-Bakhtiari. National congress of hydatid cyst. Iran Quarterly Journal of Yasouj University of Medical Sciences, 12: 76.
39. Khan, AH., AA. El-Buni And M.Y Ali, 2001. Fertility of cysts of Echinococcos granulosus in domestic herbivores from Benghazi, Libya and the reactivity of antigens produced from them. Ann. Trop. Med. Parasit., 95: 337-342.
40. Ahmadi, N.A. and M. Meshkehkar, 2011. An abattoir -based study on the prevalence and economic losses due to cystic echinococcosis in slaughtered herbivores an Ahwaz, south-western Iran. Journal. Helminthol., 85: 33-39.
41. Surhio, AS., B. Bhutto, JA. Gadahi, N. Akhtar and A. Arijo, 2011. Studies on the prevalence of caprine and ovine hydatidosis at slaughter houses of Larkana, Pakistan. Research Opinions In Animal and Veterinary Sciences., 1: 40-43.
42. Ansari-Lari, M., 2005. A retrospective survey of hydatidosis in livestock in Shiraz, Iran, based on abattoir data during 1999-2004. Vet. Parasitol., 133: 119-123.