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Prevalence and Associated Risk Factors of Hydatidosis in Cattle Slaughtered at Dejen Municipal Abattoir in Amhara Regional State, Ethiopia

[1]Y. Metages, [2]A. Simegnew, [2]S. Mesfin and [3]M. Mesfin

[1]Haramaya University, School of Animal and Range Sciences, P.O. Box: 138, Dire Dawa, Ethiopia
[2]East Gojam Zone Dejen Woreda Veterinary Clinic officer, Dejen, Ethiopia
[3]Wolaita Soddo University, School of Veterinary Medicine, P.O. Box: 138, Wolaita Soddo, Ethiopia

Abstract: Hydatidosis is a widespread parasitic zoonotic disease posing a significant public health and economic burden indeveloping countries. A cross-sectional study was conducted from March 2018 to June 2019 with the aim of determining the prevalence hydatidosis and associated risk factors in cattle slaughtered in Dejen Municipal Abattoir, Amhara Regional State, Ethiopia. Out of 384 cattle examined for the presence of hydatid cyst, 117 (30.5%) of them were found to have a cyst their internal organs. Of the 117 positive cattle, 56 (47.9%), 34 (29.1%), 16 (13.7%) and 11(9.4%) were harbor hydatid cysts in their lungs, livers, hearts and kidneys respectively. A significantly higher prevalence was detected in cattle> 5 years of age ($P<0.05$). Regarding the body condition score, the prevalence was higher for poor body condition score cattle (54.7%) followed by medium (22.4%) and fat (15.2%). The highest prevalence rate reported in this study clearly indicated that lack of plan based on control measures against the source of infection which is attributed to increasing tendencies in prevalence. Therefore, public awareness should be created about the impact of the disease, special attention being given to abattoir workers and dog owners.

Key words *:Abbatoir · Dejen · Hydatidosis · Prevalence · Risk Factor*

INTRODUCTION

In Ethiopia, livestock production is one of the major components of the agricultural economy, contributing about 30% to the poor's nutrition. The productivity is still remains marginal mainly due to malnutrition, prevalent disease, poor genetic potential of local breed, management problems and inefficiency of livestock development services with respect to credit, extension, marketing and infrastructure. Among animal diseases, parasitism represents a major obstacle for the development of the livestock sector and hampers the poverty alleviation programs in livestock farming system in the country [1]. It is evident that cystic hydatidosis/echinococcosis is an endemic parasitic problem occurring in camels, cattle, goats and sheep in Ethiopia [2].

Hydatidosis (Cystic Echinococcosis) is a zoonotic parasitic infection of many mammalian species caused by the larval stage of *Echinococcus granulosus*. Adult parasites are found in the small intestine of dogs and other carnivores [3]. The parasite eggs are passed to the environment through canid feces and infect a large number of mammalian intermediate hosts including sheep, goats, cattle and camels [4]. The metacestode (Larval) stages (Hydatid cysts) develop in the liver and lungs and occasionally, other organs like spleen, kidney and heart. The life cycle is completed when organs containing these cysts are consumed by dogs [5]. Humans become accidentally infected and hydatid cyst may develop throughout the body. The disease is not apparent to farmers but it has considerable economic and public health importance [6]. In farm animals it causes significant economic loss due to condemnation of edible organs, decreased meat and milk production, decreased fecundity and high medical cost to treat human infections [6, 7].

The incidence of human hydatid disease in any country is closely related to the prevalence of the disease in domestic animals and highest where there is a large dog population and high sheep production [8]. The most

Corresponding Author: Metages Yirgalem, Haramaya University School of Animal and Range Sciences, P.O. Box: 138, Dire Dawa, Ethiopia. Tel: +251920384810.

frequent strain associated with human cystic hydatidosis (Echinoccocosis) appears to be the common sheep strain (G1) [6, 9, 10]. Recent molecular characterization of human and animal *Echinococcus granulosus* isolates confirmed that the camel strain (G6) is a source of infection to humans [11].

In Ethiopia, where home slaughtering of cattle, sheep, goats and camels is still predominant and uncooked offal and carcass wastes are normally given for dogs and cats, hydatidosis is an endemic disease and posesgreat public health and economic importance. Different studies conducted in different parts of Ethiopia indicated that the disease is highly prevalent and pose huge economic loss. However, there is lack of information on the status of the disease cattle in Dejen area. Therefore, this study was done with the aim of determining the prevalence and associated risk factors of hydatidosis in cattle slaughtered in Dejen Municipal abattoir.

MATERIALS AND METHODS

Study Area: The study was conducted at Dejen Municipal Abattoir; Dejen woreda located about 240 km far from Addis Ababa to the North. It has an altitude of 2140 meters above sea level. The mean annual rainfall of the study area is 1450 mm and the annual minimum and maximum temperatures are 12°C and 28°C respectively. The woreda has a large livestock population, bovines (18,270), equines (6,412), sheep and goats (33,240) and poultry (11,234) [12].

Study Population: The study animals were indigenous cattle brought from various localities to Dejen municipal abattoir for slaughtering purposes. It was difficult to precisely indicate the geographical origin of all animals slaughtered in the abattoir and relate the findings on hydatidosis to a particular locality since the animal came from different areas around the city.

Study Design and Sample Size: A cross-sectional study was conducted to determine the prevalence of the disease at Dejen municipal abattoir with the aim of gathering updated information about the status of haydatidosis from March to July 2018. During the study period, both the ante mortem and postmortem inspections were carried out. Information concerning about the age, body condition score and sex of all study animals were properly recorded. The age of the sampled animals was determined by dental eruption [13]. The body condition scoring for animals was carried out based on the guide line given by Faye *et al*. [14]. The sample size was determined by simple random sampling method using 95% confidence interval at a desired absolute precession of 5% according to the formula given by the previous author [15]. Accordingly, 50% expected prevalence was used to calculate the sample size due to absence of previous study in the area.

$$n=1.96^2\times p\,(1-p)/d^2$$

where
n= number of animals to be sampled
P= expected prevalence= 50%
d =desired absolute precision= 5%

According to the above formula, the calculated sample size was 384.

Study Methodology: During the study period, both ante-mortem and postmortem inspections were carried out in accordance with the procedures of Mitchell [16].

Ante-mortem Examination: During ante-mortem inspection, the animals were visualized for any clinical illness and some pathological alterations. Information concerning the age, body condition score, sex and nutritional status of all animals were properly recorded. The age of the sampled animals was determined by dental eruption. The body condition of each study animalwas rated into poor, medium or good as has been used previously [17]. Each study animal was clearly identified based on enumerated marks on the body by usingink and this marking was transferred to all corresponding carcasses and visceral organs after slaughtering.

Postmortem Examination: During the study period, a total of 308 slaughtered cattle were examined for the presence of hydatid cysts in visceral organs including lungs, liver, heart, spleen and kidneys. The post mortem examination consisted of both primary and secondary examinations. The primary examination involved visual inspection and palpation of organs and viscera. The secondary examination involved further incisions in to each organ if a single or more cysts found. Visual inspection and palpation followed by multiple incisions in the livers, kidneys, lungs, hearts and spleens, were made to detect hydatid cysts [16].

Data Analysis: Data obtained from ante-mortem and postmortem findings in the abattoir were coded and uploaded into Microsoft Excel 2010 spreadsheet computer program. Then it was analyzed by using SPSS version16.0

for windows software and Chi-square (P2) test wasapplied to compare the infection status with regard to thehypothesized risk factors like age, sex and body condition scores.

RESULTS

Out of a total of 384 indigenous cattle slaughtered at Dejen municipal abattoir, 117 (30.5%) were found infected with one or more hydatid cysts involving different organs. The distribution, number of infected organs and mixed organ infestation rates with hydatid cysts in cattle were recorded. The appearance of the cyst in more than one organ, in one animal, was common and the majority of the cysts were lodge on lungs and livers. In this study, the infection rate among different age groups of examined animals were found to be statistically significant ($p<0.05$) with the highest prevalence in cattle with age group > 5 years (32.58 %) than cattle with age group ≤ 5years (27.5%) as shown in (Table 1).

In this study, hydatid cysts were detected in 34.6 % of the female and in 30.2 % of male cattle but there was no statistically significant difference in the prevalence of hydatidosis between sexes ($P>0.05$) (Table 2).

Out of 117 cattle infected, 56 (47.9%) have hydatid cyst in their lungs, 34 (29.1%) in livers, 16 (13.7%) in hearts and 11 (9.4%) in kidneys (Table 3).

Assessments of hydatid cyst count with body condition scoring were made; accordingly cattle with lean body condition scouring had higher prevalence (54.8%), medium (22.4%) and fat (15.2%) indicating significant difference among the different body condition score ($p<0.05$) (Table 4).

DISCUSSION

Hydatidosis is known to be important in livestock and public health in different parts of the world and its prevalence and economic significance have been reported by different researcher in different geographical areas. The prevalence may, however, vary from country to country or even within a country.

The findings of our study showed that the overall prevalence of hydatidos is in cattle was found as 30.5%, which is in line with the previous result reported from Jimma (31.44 %) [18] Ambo (29.7 %) [19] Nekemte (36.07%) [17]. On the other hand, the present finding was higher than the previous reports from different parts of Ethiopia;

Table 1: Prevalence of bovine hydatidosis with regard to age groups

Age groups (yrs.)	No. animals examined	No. infected animals	Prevalence	χ^2-Value	P-value
≤5 years	160	44	27.5%	11.795	0.0237
>5 years	224	73	32.58%		
Total	384	117	30.5%		

Table 2: Distribution of hydatid cyst in different sexes

Sex	Number of animals examined	Numbers of animals Infected	Prevalence (%)	χ^2-Value	P-value
Female	26	9	34.6	0.937	0.825
Male	358	108	30.2		
Total	384	117	30.5		

Table 3: Distribution of hydatid cysts in different organs

Organs	Number of animals infected	Prevalence from infected animals (%)	Prevalence from total examined animals (%)
Lung	56	47.86	14.58
Liver	34	29.1	8.9
heart	16	13.7	4.2
Kidney	11	9.4	2.9
Total	117		30.5

Table 4: Prevalence in different body conditions

Body condition	Total examined	Positive	Prevalence (%)	χ^2-Value	P-value
Lean	113	62	54.8	42.024	<0.001
Medium	192	43	22.4		
Fat	79	12	15.2		
Total	384	117	30.5		

for example, 8.5% in Gofa and 15.5% in Woliata [20] 17.5% in the Tigray region [21] 20.5% in Gondar Elfora Abattoir in northern Ethiopia [22] 21% in Addis Ababa Abattoir [23] and 15.5% in Debre Markos [24] and elsewhere in the world; for example, 4.2 % in Arusha Tanzania [25] 6% in Sudan [26] 7.4%in Turkey [27] 8.28 % in Sauddi Arabia [28] 10.4 % in Italy [29] and 16.4 % in Iran [30]. However, the finding in the present study was lower than 84.3% in Gondar, 68.9% in Injibara, 73.4% in Finoteselam [31] 49.5% in Shashemanne Municipal Abattoir in Oromia [32] and 48.7 % in Ngorongoro district of Arusha region in Tanzania [33] and 38.3 % in northern Iran [34].

The variation in prevalence hydatidosis in cattle between different countries and regions may be attributed mainly to differences in agroecology, time of study, stocking rates, movements of animals and animal husbandrysystems [28, 35]. Additionally, factors like difference in culture and religion, awareness, social activity and attitude to dog in different regions might have contributed to this variation [22, 36].

The higher prevalence rate in the present study area, might be due to the presence of the high number of stray dogs in the current study areas andthe abundance and frequent contact between the infected intermediate and final hosts. It could also be associated to slaughtering of aged cattle which have had considerable chance of exposure to the parasitic ova, backyard slaughtering of small ruminants and provision of infected offal's to pet animals around homesteads. Moreover, common practice of backyard and roadsides slaughtering of ruminants, a tradition of offring uncooked infected offals to dogs and cats, poor public awareness about the disease and presence of few slaughter houses, the absence of proper fencing and disposal pits for slaughter houses that allows easy access of dogs and other carnivores and lack of habit of disposing dead wild or domestic animals and unburied and left over for scavenging carnivores could have contributed to such a higher prevalence rate [19, 20, 23].

Attempts was made to assess the infection rate in different sex of the animals and the result showed that there is no significant association exists between sex and occurrence of the disease. This might be due to indiscriminate exposure of animal to the contaminated grazing area irrespective of sex. With regards to rate of infection in different age groups, significant variation ($P<0.005$) was observed. Animals with age groups >5years were highly affected than the other age categories, which is in line with other previous studies in Ethiopia [23, 37] and elsewhere in other countries [35, 38-40]. The difference infection rate could be mainly due the more prolonged exposure of older animals favors the accumulation of more number of infective stages, the development of hydatid cysts and progressive infection over longer duration of time in older age than in young cattle and a higher prevalence of cysts also suggests an absence of immunity to this parasite [35].

The prevalence of hydatidosis was higher in cattle having poor (Lean) (54.8%) followed by medium (22.4%) and fat body condition (15.2%). Polydrous [7] explained that in moderate to severe infections, the parasite may cause retarded performance and growth, reduced quality of meat and milk, as well as live weight loss.

From the organ prevalence study, lung was found to be the most commonly affected organ followed by liver. This could be justified by the fact that livers and lungs possess the first greater capillary sites which acts as partial barriers for the ingested oncosphere during their portal vein route that are primarily subjected to hepatic and pulmonary filtering system before the involvement of anyother peripheral organ [41]. Additionally, it is also possible for the embryo to enter the hepatic circulation and be carried via the thoracic duct to the heart and lungs in such a way that the lung may be infected before the liver and / or instead of the liver. Similar findings were reported by different authors [37, 42]. But, this result contradicts with the study reported by Soulsby [43]. The kidneys and hearts are the least affected organs. However, similar findings with the present study were also obtained by various workers and it is indicated that liver and lungs are the most commonly affected organs with hydatid cyst due to the reason that they are the first capillary fields encountered by the blood borne oncospheres of the parasite [44].

Lung harbored higher number of large and medium sized cysts, while liver was found to harbor higher number of small and calcified cysts. The high number of large and medium sized cysts in lung may be due to relatively softer consistency [45]. The higher number of calcified cysts in the liver could be attributed to the reticulo-endothelial and connective tissue of the organ [46]. This finding is in agreement to the findings of Yihdego [37]. The result of the present study revealed that lung is the most common organ affected by hydatid cyst followed by liver. This result is supported by the work of different researcher in different periods [37, 47].

CONCLUSION

This study revealed a high prevalence of hydatidosis in cattle slaughtered at Dejen municipal abattoir. The high prevalence rates reported in this study clearly indicated

that lack of plan based on control measure against the source of infection of this disease which is attributed for increasing tendencies in prevalence. In the rural area, most farmer kept at least one dog and they are usually used to guard the livestock in area outside the farm house at grazing sites with resultant contamination of pasture with their faces, which may contain eggs of *Echinococcus granulosus* and infection of domestic animals. Therefore, the parasite requires serious veterinary and public attentions; further community-based participatory and integrated hydatidosis control approaches are required.

REFERENCES

1. Bulto, G., H. Yacob, T. Getachew and A. Hagos, 2014. Comparative prevalence of hydatidosis in slaughtered domestic ruminants at four abattoirs of central Oromia, Ethiopia. Ethiopian Veterinary Journal, 18: 29-41.
2. Kebede, N., Z. Gebre-Egziabher, G. Tilahun and A. Wossene, 2011. Prevalence and Financial effects of hydatidosis in cattle slaughtered in Birre-Sheleko and Dangila Abattoirs. Zoonoses and Public Health, 58: 41-46. DOI:10.1111/j.1863-2378.2009.01250.x.
3. Koskei, P.K., 1998. Prevalence and strain differentiation of Echinococcus granulosus in some selected sites of Ethiopia. Berlin and Ethiopia: Freie Universität and Addis Ababa University, MSc Thesis.
4. Gemmel, M.A., 1990. Australian contributions to an understanding of the epidemiology and control of hydatid disease caused by Echinococcus granulosus past, present and future. International Journal for Parasitology, 20: 431-456. DOI: 10.1016/0020-7519(90)90192-p.
5. Torgerson, P.R. and P. Deplazes, 2009. Echinococcosis: diagnosis and diagnostic interpretation in population studies. Trends in Parasitology, 25: 164-170. DOI:10.1016/ j.pt.2008.12.008.
6. Torgerson, P.R., 2003. Economic effects of echinococcosis. Acta Tropica, 85: 113-118.
7. Polydorous, K., 1981. Animal health and economics case study: Echinococcosiss with the reference to Cyprus. Bulletin de l'Office International des Epizooties, 93: 195-203.
8. Khurro, M., 2002. Hydatid disease current status and recent advances. Annals of Saudi Medicine, 122: 56-64.
9. Arambulop, P., 1997. Public health importance of cystic Echinococcosis in Latin America. Acta Tropica, 67: 113-124.
10. Wani, S.A., F. Ahmad, S.A. Zargar, B.A. Fomda, Z. Ahmad and P. Ahmad, 2007. Helminthic infestation in children of Kupwara district: A prospective study. Indian Journal of Medical Microbiology, 25: 398-400.
11. Magambo, J., E. Njoroge and E. Zeyhle, 2006. Epidemiology and control of echinococcosis in sub-Saharan Africa. Parasitology International, 55: 193-195.
12. WAO, 2004. Woreda Agricultural Office of Meket Woreda. Annual reports.
13. De-Lahunta, R. and E. Habel, 1986. Teeth, applied veterinary anatomy. W.B. Saunders Company, pp: 4-6.
14. Faye, B., M. Bengoumi, A. Cleradin, A. Tabarani and Y. Chilliard, 2001. Body condition score in dromedary camel: A too for management of reproduction. Emirates Journal of Agricultural Sciences, 13: 01-06.
15. Thrusfied, M., 2005. Veterinary Epidemiology. 2nd edn. Blackwell science Ltd, UK.pp: 233.
16. Mitchell, J.R., 1980. Guide to meat inspection in the tropics. Common wealth Agricultural Bureaux, Farnham Royal Bucks, England. ISBN 0-85198-456-8. pp: 36-40.
17. Kumsa, B., 1994. Hydatidosis in Nekemet: prevalence in slaughtered cattle and sheep estimated economic loss and incidence in stray dog. DVM Thesis, Addis Ababa University, Faculty of Veterinary Medicine, Debre-Zeit, Ethiopia.
18. Tolosa, T., W. Tigre, G. Teka and P. Dorny, 2009. Prevalence of bovine cysticercosis and hydatodosis in Jimma municipal abattoir, southwest Ethiopia. Onderstepoort Journal of Veterinary Research, 76:323-326. DOI: 10.4102/ojvr.v76i3.37.
19. Zewdu, E., Y. Teshome and A. Makwoya, 2010. Bovine hydatidosis in Ambo Municipal Abattoir. Ethiopian Veterinary Journal, 14: 1-14.
20. Regassa, A., F. Abunna, A. Mulugeta and B. Megersa, 2009. Major metacestodes in cattle slaughtered at Wolaita Soddo Municipal abattoir, Southern Ethiopia: Prevalence, cyst viability, organ distribution and socioeconomic implications. Tropical Animal Health and Production, 41: 1495-1502.
21. Gebremeskel, B. and K. Kalayo, 2009. Prevalence, viability and fertility study of bovine cystic echinococcosis in Mekelle city, Northern Ethiopia. Revue de Médecine Vétérinaire, 160: 92-97.

22. Abebe, A., D. Beyene and B. Kumsa, 2014. Cystic echinococcosis in cattle slaughtered at Gondar Elfora export Abattoir, Northwest, Ethiopia. Journal of Parasitic Diseases, 107:229-234. DOI:10.1007/s12639-013-0255-z.
23. Kumsa, B., 2019. Cystic echinococcosis in slaughtered cattle at Addis Ababa Abattoir enterprise, Ethiopia. Veterinary and Animal Science, 7:1-5. doi:10.1016/j.vas.2019.100050.
24. Addis, M. and A. Sime, 2018. The prevalence and possible risk factors of bovine hydatidosis in Debre Markos Municipal abbatoir, Northwest Ethiopia. Journal of Natural Science Research, 8: 57-67.
25. Nonga, H.E. and E.D. Karimuribo, 2009. A retrospective survey of hydatidosis in livestock in Arusha, Tanzania, based on abattoir data during 2005-2007. Tropical Animal Health and Production, 41:1253-1257. DOI: 10.1007/s11250-009-9308-9.
26. Elmahdi, I.E., Q.M. Ali, M.A Magzoub, A.M. Ibrahim, M.B. Saad and T. Romig, 2004. Cystic echinococcosis of livestock and humans in central Sudan. Annals of Tropical Medicine and Parasitology, 98: 473-479.
27. Sariozkan, S. and C. Yalcin, 2009. Estimating the production losses due to cystic echinococcosis in ruminants in Turkey. Veterinary Parasitology, 163: 330-334.
28. Ibrahim, M.M., 2010. Study of cystic echinococcosis in slaughtered animals in Al Baha region, Saudi Arabia: interaction between some biotic and abiotic factors. Acta Tropica, 113: 26-33.
29. Rinaldi, L., M.P. Maurelli, P. Veneziano, F. Capuano and A.G. Perugini, 2008. The role of cattle in the epidemiology of Echinococcus granulosus in an endemic area of southern Italy. Parasitologial Research, 103: 175-179.
30. Dalimi, A., G. Motamedi, M. Hosseini, B. Mohammadian, H. Malaki, Z. Ghamari and F. Ghaffari, 2002. Echinococcosis/hydatidosis in western Iran. Veterinary Parasitology, 105: 161-171.
31. Kebede, N., 2010. A retrospective survey of bovine hydatidosis in three abattoirs of Amhara National Regional State, north-western Ethiopia. Tropical Animal Health and Production, 42: 323-325.
32. Negash, K., D. Beyene and B. Kumsa, 2013. Cystic echinococcosis in cattle slaughtered at Shashemanne Municipal Abattoir, South central Oromia, Ethiopia: Prevalence, cyst distribution and fertility. Transactions of the Royal Society of Tropical Medicine and Hygiene, 107: 229-234. DOI:10.1093/trstmh/trt003.
33. Ernest, E., H. Nonga, A. Kassuku and R. Kazwala, 2008. Hydatidosis of slaughtered animals in Ngorongoro district of Arusha region, Tanzania. Tropical Animal Health and Production, 41:1179-1185. DOI: 10.1007/s11250-008-9298-z.
34. Daryani, A., R. Alaei, R. Arab, M. Sharif, M.H. Dehghan and H. Ziaei, 2007. The prevalence, intensity and viability of hydatid cysts in slaughtered animals in the Ardabil province of Northwest Iran. Journal of Helminthology, 81: 13-17.
35. Cardona, G. and D. Carmena, 2013. A review of the global prevalence, molecular epidemiology and economics of cystic echinococcosis in production animals. Veterinary Parasitology, 192: 10-32. doi: org/10.1016/j.vetpar.2012.09.027.
36. Macpherson, L.N., 1985. Epidemiology of hydatid disease in Kenya. A study of domestic intermediate hosts in Masaialand. Transactions of the Royal Society of Tropical Medicine and Hygiene, 79: 209-217.
37. Yihdego, H., 1997. Hydatidosis: Prevalence and economic impact in bovine at Mekele municipal abattoir, zoonotic and infection in dogs. DVM thesis, AAU, FVM. Debrezeit, Ethiopia.
38. Azlaf, R. and A. Dakkak, 2006. Epidemiological study of the cystic Echinococcosis in Morocco. Veterinary Parasitology, 137:83-93. DOI: 10.1016/ j.vetpar.2006.01.003.
39. Esatgil, M. and M. Tuzer, 2007. Prevalence of hydatidosis in slaughtered animals in Thrace, Turkey. Turkiye Parazitoloji Dergisi, 31: 41-45.
40. Umur, S., 2003. Prevalence and Economic Importance of cystic Echinococcosis in Slaughtered Ruminants in Burdur, Turkey. Journal of Veterinary Medicine, 50: 247-252.
41. Kumsa, B. and A. Mohammedzein, 2014. Prevalence, organ distribution, risk factors and financial losses of hydatid cysts in sheep and goats slaughtered in restaurants in Jimma, south western Oromia. Comparative Clinical Pathology, 23: 333-339. doi:10.1007/s00580-012-1619-y.
42. Olika, F., 1997. Study on prevalence and economic significance of hydatidosis ruminants and Echinococcu sgranulosus in dogs in and around Assella. DVM thesis, AAU, FVM, Debre-Zeit, Ethiopia.
43. Soulsby, E.L., 1982. Helminthes Arthropods and protozoa of domesticated animals, 7th edition, Philadelphian, pp: 119-389.

44. Angus, T., 1987. Veterinary Helminthology In 2nd (Edn.) William Henmann medical book Ltd, London, UK, pp: 332.29.
45. Symth, D., 1994. Introduction Animal Parasitology. Londen, Hodder Stoughton, pp: 259-273.
46. George, K.F. and K. Diame, 1981. Hydatid disease in Ethiopia, Clinical survey with some immunodiagnostic results. American journal of Tropical Medicine and Hygiene, 30: 645-652.
47. Himones, C., 1987. The fertility of hydatid cyst in food animals in Greece. Helminthe zoonotic, Moritins Nijhoft publishers, Netherlands, pp: 12-18.