Original Research

Rare Presentations of Cystic Lung and Liver Disease in Cattle and Buffaloes

Shabnam Sidhu*, S. K. Uppal, Ashwani Kumar, D. K. Gupta and C. S. Randhawa

Department of Veterinary Medicine, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, Punjab, INDIA

***Corresponding author:** vetsidhu@gmail.com

Rec. Date:	Jan 29, 2019 13:59
Accept Date:	Feb 25, 2019 07:31
DOI	10.5455/ijlr.20190129015934

Abstract

The present study was conducted on twelve female bovines (buffalo=7 and cattle=5) presented to Teaching Veterinary Hospital of GADVASU with clinical signs suggestive of cardiac insufficiency. The clinical examination followed by ultrasonography revealed presence of single or multiple lung and/or liver cysts in these patients. The common clinical signs were brisket edema (n=9), brisket+limb edema (n=2), jugular engorgement (n=3), dyspnoea (n=6), abducted elbows (n=3) and fever (n=3). Upon ultrasonography, single and multiple cystic densities in hepatic tissue (n=10) & lung parenchyma (n=11) were observed. A significant finding was compression of the heart (n=8) due to multiple cysts in the lungs that lead to cardiac tamponade i.e. inability of heart to pump to its full capacity which may have advanced to clinical signs mimicking that of cardiac insufficiency. Present study reports ultrasonographic diagnosis of lung or liver cysts with occurrence of atypical signs like ventral edema, dyspnoea and jugular distension.

Key words: Brisket Edema, Buffalo, Cattle, Clinical Signs, Hydatid Cyst, Intermediate Host

How to cite: Sidhu, S., Uppal, S., Kumar, A., Gupta, D., & Randhawa, C. (2019). Rare Presentations of Cystic Lung and Liver Disease in Cattle and Buffaloes. International Journal of Livestock Research, 9(4), 32-40. doi: 10.5455/ijlr.20190129015934

Introduction

Cystic echinococcosis (CE) caused by the metacestode stage of *Echinococcus granulosus* is a cause of major public health concern worldwide. It is one of the important emerging and re-emerging parasitic zoonosis endemic in India, which affects a wide range of mammals (Cardona and Carmena, 2013). Carnivores (definitive host) carry the adult worms in the small intestine and intermediate larval stage (hydatid cyst) develops in the internal organs of various mammalian species. The intermediate hosts (human beings and ruminants) acquire the infection through ingestion of infected eggs (Eckert and Deplazes, 2004). The parasite has been recorded from the most food producing animals in the country (Pednekar *et al*., 2009). The infection leads to heavy economic losses due to the condemnation of infected offals, particularly liver and lungs and to lowered meat and milk production (Torgerson, 2003). The contributing factors to the

higher incidence of hydatid disease in developing countries like India are presence of stray dogs, poor sanitary infrastructure, free access of dogs to slaughter waste, low public awareness and lack of strict meat inspection measures (Singh *et al.*, 2012). In the food producing animals, the disease is mostly considered asymptomatic and the definitive diagnosis is usually made on slaughter or post mortem (Khan *et al.*, 2010). Mostly the infected intermediate hosts may remain asymptomatic or may have signs and symptoms similar to the human disease (Schwabe, 1986). Ante-mortem diagnosis of lung and liver cysts is a serious problem, as till now no specific clinical signs have been identified. A recent report documented symptoms like coughing, dyspnoea and stridor in dairy cattle and buffaloes with cystic densities in the lung area (Chuadhari *et al.*, 2017).

Detection of lung and liver cysts in live animals is very important as it may be useful in the assessment of disease severity and therefore such animals may be culled to prevent spread of this catastrophic zoonoses. Despite of all these factors, the clinical presentation of hydatid disease is poorly understood in bovine hosts. The current study will help veterinary practitioners in the better understanding of clinical signs associated with the disease and in the differential diagnosis where the clinical signs may mimic diseases of other organ systems.

Material and Methods

Animals, History and Physical Examination

The study included twelve sick bovine animals (buffalo-7; cattle-5) presented to the Teaching Veterinary Hospital, Guru Angad Dev Veterinary & Animal Sciences University with the clinical signs indicative of cardiac insufficiency. Suspecting some cardiac involvement, these animals were subjected to a comprehensive clinical examination and detailed history and clinical symptoms were recorded. Blood samples were collected for routine hemato-biochemical examination(s) to note down any changes associated with the disease.

Ultrasonography

Owing to the suspicion of some cardiac affection, detailed thoracic and abdominal ultrasonography was carried out. For ultrasonographic examination, animals were prepared by clipping hair from lung (5-12 ICS in shape of triangle, both sides) and liver (5-12 ICS, right side) region. The multi frequency convex transducer (3.5-5 MHz) with penetration depth of 30 cm was moved dorsoventrally at each intercostal space in standing animals using M-turbo portable ultrasound scanner (FUJIFILM SonoSite, Inc. USA). Detection of any cavitary lesion in the hepatic parenchyma (Fig. 1) or in lung region/ surface (Fig. 2) was used as a criterion in the detection of cyst. Cardiac ultrasound as described by Braun *et al.* (2001) was performed

DOI 10.5455/ijlr.20190129015934

using 1-5 MHz sector cardiac probe to evaluate the cardiac functioning. The patients were prepared by shaving 25 x 25 cm area over the 3rd-5th ICS on both left and right side.

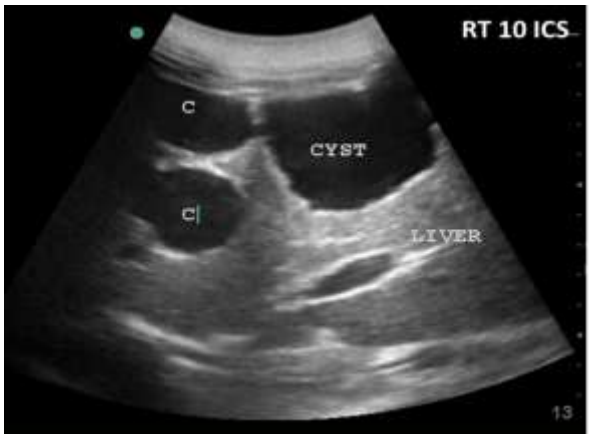

Fig. 1: Ultrasonographic image showing three encapsulated thin walled cavitary lesions (C) in the hepatic parenchyma

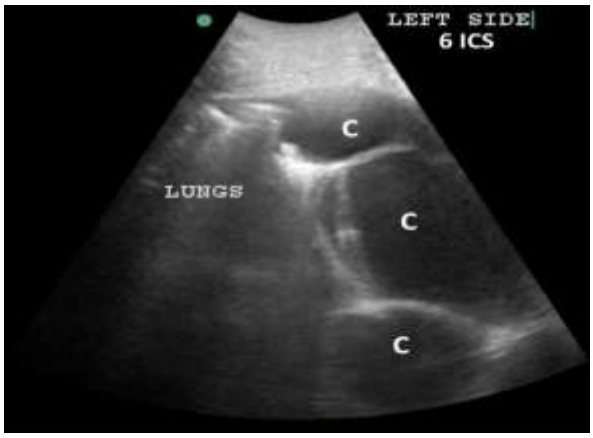

Fig. 2: Ultrasonographic image showing three cystic lesions (C) on the lung surface

Statistical Analysis

Mean and standard error means for various parameters were calculated using the SAS software. The subjective parameters were compared using percentage

Results and Discussion

Physical Examination and Clinical Signs

The study included seven buffalo and five cattle that were presented with clinical symptoms suggestive of cardiac insufficiency. All the presented animals were adult females with mean age of 6.8±0.72 years (range 4-10 years). Similar to the observations in the present study higher prevalence of hydatid disease is observed in older animals (Salih *et al.*, 2011, Lahmar *et al.*, 2012, Kumar *et al.*, 2016), clearly indicative of positive increase in the infection with age. Old animals are likely to acquire infection, possibly due to their longer exposure to infection and lower immunity to combat infection. Out of these 12 cases, 6 animals were non-pregnant and 6 were pregnant. Equal prevalence of infection has been reported in breeding and non-breeding populations (Singh *et al.*, 2014). Khan *et al.* (2010) reported higher prevalence in female animals as compared to males. The most likely reason is that female animals are kept for a longer period of time due to production reasons and also immunodeficiency and decreased cell-mediated immunity in pregnancy and the lactation period may increase the susceptibility of females for cystic infection (Pour *et al.*, 2012). Four animals were anorexic with rest of the animals having partial anorexia. Kumar *et al.* (2016) reported partial anorexia in 38% and rest 62% were completely anorectic. The physical examination parameters were within the normal range except for respiration rate >50 in two buffaloes and one cattle. Cardiac auscultation

 DOI 10.5455/ijlr.20190129015934

revealed tachycardia (HR >100 bpm) in three cattle. Three buffaloes had muffled heart sounds, otherwise all other animals had normal intensity of heart sounds. Tachycardia and muffled heart sounds are the pathognomic indicators of congestive heart failure but have also been reported in cases with thoracic lesions (abscess or tumours) (Abdelaal *et al.*, 2009).

The clinical signs that increased the suspicion of cardiac involvement are depicted in Table 1. The cited literature reports hydatid disease is asymptomatic in the intermediate host (Jayathilakan *et al.*, 2010). However, the spectrum of clinical signs may vary and depend on the number, size, severity of cystic lesions and adjacent organs, resulting in impaired function of that particular organ (Besbes *et al.*, 2010). Apart from loss of defecation and tympany, Kumar *et al*. (2016) reported brisket edema in 11.11% and respiratory distress in 31.11% bovines with lung and/or liver cysts, which is far less than observed in the present study.

Table 1: Clinical signs in bovines with lung and/or liver cysts (n=12)

Clinical Signs	Buffalo (n=7)	Cattle (n=5)	Total (n=12)
Brisket edema	6(85.7%)	3(60%)	9(75%)
Brisket+jowl+limb	1(14.3%)	1(20%)	2(16.6%)
Bilateral jugular engorgment	2(28.6%)	1(20%)	3(25%)
Dyspnoea/open mouth breathing	3(42.8%)	3(60%)	6(50%)
Abduction of elbows	2(28.6%)	1(20%)	3(25%)
Fever	1(14.3%)	2(40%)	3(25%)

In a recent study, Chuadhari *et al.* (2017) reported coughing, dyspnoea and stridor in three dairy animals with cystic echinococcosis in the lung parenchyma. Respiratory distress or open mouth breathing in the present study could be correlated with the location and size of cysts present in the lung parenchyma leading to reduced functional space of the lung (Besbes *et al.*, 2010). Presence of cystic densities in the pleural cavity may have lead to the development of edema of the ventral parts of the body and bilateral jugular engorgement. Tumours, abscesses, echinococcus cysts, swollen lymph nodes have been reported to cause pseudopericarditis in bovines with similar signs like neck edema and jugular vein engorgement (Keles *et al.*, 2003). The jugular veins can be distended, without signs of right-sided cardiac insufficiency due to obstruction or compression of the cranial vena cava by thrombi or intrathoracic masses (Braun *et al.*, 2007).

Hemato-Biochemical Analysis

Hematological findings viz. haemoglobin 9.67±0.56 g% (Mean±SE) and total leukocyte count 8793.33±925.26/µl (Mean±SE). All the 12 animals had a normal hemogram except for anemia in two cases. Chaudhari *et al.* (2017) reported haemoglobin to be 8.6 ± 4.20 g/dl and total leukocyte count-10,605 ± 3904.89/µl in three dairy animals with cystic echinococcosis presented with signs of coughing, dyspnoea and stridor. The mean values of various biochemical parameters from the present study are given in Table

DOI 10.5455/ijlr.20190129015934

2. In the current study the values of liver function tests (AST and GGT) were higher than the normal physiological reference range (Radostits *et al.*, 2007). The increase in the liver enzyme values can be attributed to dysfunction of the organ caused by the presence of cysts which may have ultimately lead to passive liver congestion thus appearance of symptoms like that of congestive heart failure viz. brisket edema and jugular engorgement. Serum total protein and albumin levels in the present study were also lower than the reference range for healthy animals (Radostits *et al.*, 2007). The results can be ascribed to chronic anorexia (Kaneko, 1997) or failure of liver to synthesize adequate amounts of protein due to impaired liver function (Tennant and Center, 2008). Significantly decreased levels of serum albumin and creatinine have been reported in sheep with cystic echinococcosis (Sagkan-Ozturk *et al*., 2015). However, in the present study the values of serum BUN and creatinine were within the normal range. It has been previously reported that cystic echinococcosis grows progressively and produces pressure atrophy in the affected organs, leading to functional alterations (Barnes *et al.*, 2011).

Table 2: Mean±SEM of various biochemical parameters in animals with liver and/or lung disease (n=12)

Parameter	Buffalo (n=7)	Cattle (n=5)	Overall (n=12)
AST	201.14±35.89[1]	207.4±66.87	203.75±28.33
(IU/L)	(112-356)[2]	(81-364)	(81-364)
GGT	237.57±50.40	225.4±128.96	232.5±47.64
(IU/L)	(67-465)	(27-594)	(27-594)
TP	6.05±0.16	6.24±0.43	6.13±0.16
(g/dL)	(5.4-6.7)	(5-6.9)	(5-6.9)
Albumin	2.3±0.24	1.96±0.09	2.15±0.14
(g/dL)	(1.6-3.1)	(1.8-2.2)	(1.6-3.1)
BUN	26.28±5.79	14.0±4.99	21.16±4.02
(mg/dL)	(12-48)	(9-29)	(9-48)
Creatinine	1.52±0.25	0.98±0.09	1.3±0.16
(mg/dL)	(0.8-2.7)	(0.8-1.2)	(0.8-2.7)

[1]*Values are Mean±SEM of that particular parameter;* [2]*Values in parenthesis depict range*

Ultrasonography

Ultrasonography efficiently aided in the detection of single or multiple, encapsulated, thin or thick walled cavitary lesions, within the hepatic parenchyma (Fig. 1) in 83.33% cases and lung tissue (Fig. 2) in 91.66% of the presented animals. Tolosa *et al.* (2009) reported highest prevalence of cysts in lungs (57%) followed by liver (34%), spleen (5%), heart (3%) and kidneys (1%). Our findings are in co-relation with Nadery *et al.* (2011), Pour *et al.* (2012) and Khan *et al.* (2013) who also reported higher prevalence in lungs as compared to liver. In the current study no cysts were detected in the heart upon ultrasonography. Similar results were reported by Khan *et al.* (2013) in an abbatoir study of hydatidosis in buffaloes. Nine out of twelve animals (75%) had both lung and liver cysts on ultrasonography, suggestive of high co-occurrence of lung and liver cysts in the intermediate host. Kumar *et al.* (2016) reported concurrent infection of both

 DOI 10.5455/ijlr.20190129015934

hepatic and pulmonary parenchyma in 46.7% of the animals. In our study more number of animals were found to be affected with multiple cysts of lung (n=8) and liver (n=7) (Table 3). The probable explanation of this finding could be the long course of illness as most of the animals presented to us were sick from nearly one month. Clinical manifestations are mild in the early stage, which can be overlooked by the owner, while as the cysts gradually grow and multiply, the parasite may physically damage tissues and organs, which can become dysfunctional at the later stages of echinococcosis and thus leads to appearance of severe signs (Zhang and Mc Manus, 2006).

Table 3: Ultrasonographic detection of single or multiple cysts in liver and/or lung

Number of Cysts	Single Cysts		Total	Multiple Cysts		Total	Grand Total
	Buffalo	Cattle		Buffalo	Cattle		
Lung (n=11)	1	2	3 (27.3%)	6	2	8 (72.3%)	11
Liver (n=10)	1	2	3 (30%)	5	2	7 (70%)	10

After the diagnosis of lung and/or liver cyst was made, a further evaluation about the effect of cystic density in the affected organ and the adjacent organ structures was attempted. Among buffaloes, two animals had pleural effusions but these were without any signs of respiratory distress or dyspnoea (Table 4).

Table 4: Ultrasonographic detection of other conditions due to presence of cysts in lung and/or liver (n=12)

Condition	Buffalo		Cattle	
	No.	Clinical SIGNS	No.	Clinical Signs
Pleural effusions (n=2)	2	Brisket edema (1), Brisket+limb+jowl edema (1)	0	-
Hepatic congestion (n=8)	4	Brisket edema (4), jugular engorgment (2), dyspnoea (2)	4	Brisket edema (2), dyspnoea (2)
Compression of heart (n=8)	5	Brisket edema (5), jugular engorgement (2), dyspnoea (2)	3	Brisket edema (1), dyspnoea (2)

Dyspnoea or open mouth breathing, in this study, could be correlated to the size, location or severity of cystic lesions in the lung parenchyma (Besbes *et al*., 2010). USG of four buffaloes and four cows having brisket edema and jugular engorgement also showed marked hepatic congestion characterized by dilated and oval or round caudal vena cava (Fig. 3). Persistent dilatation of posterior vena cava is indicative of systemic congestion. It may be caused by cardiac insufficiency due to pericarditis, thrombosis of the caudal vena cava or compression of the caudal vena cava in the thorax or in the subphrenic region by some space-occupying lesion (Kumar *et al.*, 2012). An interesting finding in the present study was the acute compression of heart (buffaloes-5, cattle-3) due to massive cystic degeneration of the lungs leading to cardiac tamponade wherein heart is unable to pump blood to its full capacity (Fig. 4).

DOI 10.5455/ijlr.20190129015934

Fig. 3: Ultrasonographic image of liver showing hepatic congestion (dilated caudal vena cava (CVC) and hepatic veins (HV)

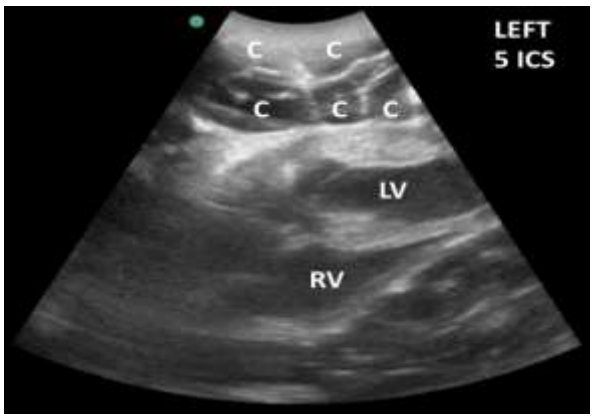

Fig 4: Cardiac ultrasound image showing compression of the heart due to multiple cystic densities (C). Left ventricle (LV), Right ventricle (RV)

The cardiac ultrasound in these cases revealed diastolic compression of the ventricles, findings typical in cardiac tamponade (Firshman *et al.*, 2006). Otherwise the heart appeared to be normal with no pericardial deposits/effusions, thus confirming the cysts to be the primary cause of clinical symptoms mimicking signs of congestive heart failure in the animals included in the current study.

Conclusion

Depending on the number, size and location, lung and/or liver cysts can be the primary cause of disease. Ultrasonography could be used as a screening tool in living animals for the detection of lung and/or liver cysts in the endemic areas to prevent the spread of this disasterous zoonoses. Hydatid disease still remains an asymptomatic disease in the intermediate hosts and veterinarians should consider this disease for differential diagnosis while investigating the cause of clinical signs like brisket edema, jugular engorgement and dyspnoea etc.

References

1. Abdelaal, A.M., Floeck, M., El-Maghawry, S. and Baumgartner, S. (2009). Clinical and ultrasonographic differences between cattle and buffaloes with various sequelae of traumatic reticuloperitonitis. *Veterinary Medicine*, 54: 399–406.
2. Barnes, T. S., Hinds, L. A., Jenkins, D. J., Bielefeldt-Ohmann, H., Lightowlers, M. W. and Coleman, G. T. (2011). Comparative pathology of pulmonary hydatid cysts in macropods and sheep. *Journal of Comparative Pathology*, 144: 113–22.
3. Besbes, L.G., Haddad, S., Meriem, C.B., Hammami, S., Nauri, A. and Gueddiche, M.N. (2010). Giant hydatid lung cysts: About two pediatric cases. *Respiratory Medicine. CME*, 3: 174-178.
4. Braun, U., Lejeune, B., Schweizer, G., Puorger, M. and Whrensprenger, F. (2007). Clinical findings in 28 cattle with traumatic pericarditis. *Veterinary Record*, 161: 558-63.
5. Braun, U., Schweizer, T. and Pusterla, N. (2001). Echocardiography of the normal bovine heart: technique and ultrasonographic appearance. *Veterinary Record*, 148: 47-51.

DOI 10.5455/ijlr.20190129015934

6. Cardona, G.A. and Carmena, D. (2013). A review of global prevalence, molecular epidemiology and economics of cystic echinococcosis in production animals. *Veterinary Parasitol*ogy, 192(1): 10-32.
7. Chaudhari V., Sharma A.K., Singh B.B., Randhawa C.S. and Uppal, S.K. (2017). Stridor and emphysema due to cystic echinococcosis in cattle and buffalo intermediate hosts in Punjab, India. *Veterinary Parasitology: Regional Studies and Reports*, 10: 51–53.
8. Eckert, J. and Deplazes, P. (2004). Biological, epidemiological, and clinical aspects of echinococcosis, a zoonosis of increasing concern. *Clinical Microbiological Review*, 17: 107–135.
9. Firshman, A. M., Sage, A. M., Valberg, S. J., Kaese, H. J., Hunt, L., Kenney, D. and Murphy, M. J. (2006). Idiopathic hemorrhagic pericardial effusion in cows. *Journal of Veterinary Internal Medicine*, 20(6): 1499-1502.
10. Jayathilakan, N., Basith, S.A., John, L., Chandaran, N.D.L. and Raj, G.D. (2010). Development and evaluation of flow through technique for diagnosis of cystic echinococcosis in cattle. *Veterinary Archive*, 80(5): 549-559.
11. Kaneko, J. J. (1997). Serum proteins and dysproteinemias. In: Kaneko J J, Harvey J W and Brus M L (Eds). Clinical biochemistry of domestic animals, 5th ed. Academic Press, London, pp 117-138.
12. Keles, I., Alptekin, I., Atasoy, N., Cinar, A., Donmez, N. and Ceylan, E. (2003). Pseudopericarditis in a cow caused by theileriosis- a case report. *Veterinarski Arhiv*, 73(2): 111-17.
13. Khan, M.A., Gazi, M. and Bashir, S. (2013). Seasonal prevalence of hydatidosis in buffaloes –A retrospective study. *Veterinary World*, 6(9): 647-650
14. Khan, M.A., Tanveer, A., Younus, M., Shafiq, M., Saeed, K., Ammaram, H.T. and Gill, T.J. (2010). Prevalence, organ specificity and economic impact of hydatidosis in the cattle slaughtered in the Lahore Abattoir. *International Journal for Agro Veterinary and Medical Sciences*, 4(2): 38-40.
15. Kumar, A., Saini, N.S., Mohindroo, J. and Sood, N.K. (2012). Ultrasonographic features of normal heart and liver in relation to diagnose pericarditis in bovine. *Indian Journal of Animal Science*, 82(12): 1489-1494.
16. Kumar, A., Saini, N.S., Mohindroo, J., Singh, B.B., Sangwan, V. and Sood, N.K. (2016). Comparison of radiography and ultrasonography in the detection of lung and liver cysts in cattle and buffaloes. *Veterinary World*, *9*(10): 1113-1120.
17. Lahmar, S., Trifi, M., Ben Naceur, S., Bouchhima, T., Lahouar, N., Lamouchi, I., Maamouri, N., Selmi, R., Dhibi and Torgerson, P.R. (2012). Cystic echinococcosis in slaughtered domestic ruminants from Tunisia. *Journal of Helminthology*, 1-8.
18. Nadery, B. Mahdi, Y. and Mohammmad, A.D. (2011). Survey on Hydatid cyst infestation in Sarab city using Epidemological and Seroepidemological study. *Journal of Animal and Veterinary Advances*, 10(16): 2099-2101.
19. Pednekar, P.R., Gatne, L.M., Thompson, R.C.A. and Traub, R.J. (2009). Molecular and morphological characterisation of Echinococcus from food producing animals in India. *Veterinary Parasitology*, 165: 58–65.
20. Pour, A. Amin, Hosseini, S.H. and Shayan, P. (2012). The prevalence and fertility of hydatid cysts in buffaloes from Iran. *Journal of Helminthology*, 86(3): 373-377.
21. Radostits, O. M., Gay, C. C., Hinchcliff, K. and Constable, P. D. (2007). Veterinary Medicine. A Textbook of the Diseases of Cattle, Horses, Sheep, Pigs, and Goats, 10th edn. pp 3-31, 293-375, 2047-2050. Saunders Elsevier, Philadelphia
22. Sagkan-Ozturka, A, Durguta, R. and Ozturkba Mustafa, O.H. (2015). Helminths Oxidant/antioxidant status in lambs and sheep with liver and lung cystic echinococcosis diagnosed by ultrasonography and necropsy. *Veterinary Parasitology,* XXX: 1-6
23. Salih, M., Degefu, H. and Yohannes, M. (2011). Infection rates, cyst fertility and larval viability of hydatid disease in camels (*Camelus dromedarius*) from Borena, Kereyu and Harar areas of Ethiopia. *Global Veterinarian*, 7(6): 518-522.

 DOI 10.5455/ijlr.20190129015934

24. Schwabe, L. (1986). Current status of hydatid disease: a zoonosis of increasing importance. In: Thompson, R.C.A. (Ed.), The Biology of Echinococcus and Hydatid Disease. G. Allen & Unwin, London, pp. 81–113.
25. Singh, B.B., Dhand, N. K., Ghatak, S. and Gill, J.P.S. (2014). Economic losses due to cystic echinococcosis in India: Need for urgent action to control the disease. *Preventive Veterinary Medicine*, 113: 1– 12.
26. Singh, B.B., Sharma, J.K., Ghatak, S., Sharma, R., Bal, M.S., Tuli, A. and Gill, J.P.S. (2012). Molecular epidemiology of Echinococcosis from food producing animals in north India. *Veterinary*. *Parasitology*, 186(3-4): 503–506.
27. Tennant, B.C. and Center, S.A. (2008). Chapter 13: hepatic function. In Clinical Biochemistry of Domestic Animals. Sixth ed. In: Kaneko, J. J., Harvey, J.W., Bruss, M.L. (Eds.), Academic Press, New York, USA,pp. 379–412.
28. Tolosa, T., Tigre, W., Teka, G. And Dorny, P. (2009) Prevalence of bovine cysticercosis and hydatidosis in Jimma municipal abattoir, South West Ethiopia *Onderstepoort Journal of Veterinary Research*, 76: 323–326
29. Torgerson, P.R., Burtisurnov, K. K., Shakenov, B.S., Rysmukhambetova, A.T., Abdybekova, A.M. and Ussenbayev, A.E. (2003). Modelling transmission dynamics of Echinococcus granulosus in sheep and cattle in Kazakhstan. *Veterinary Parasitology*, 111: 143–153.
30. Zhang, W. and McManus, D.P. (2006). Recent advances in the immunology and diagnosis of echinococcosis. *FEMS Immunoogy and Medical Microbiology*, 47: 24–41.

DOI 10.5455/ijlr.20190129015934