The Journal of Animal & Plant Sciences, 26(4): 2016, Page: 1187-1190
ISSN: 1018-7081

Short communication

CYSTICERCUS BOVIS INDUCED HEMATO-BIOCHEMICAL CHANGES IN CATTLE AND BUFFALOES

M. Saeed[1], A.Z. Durrani[1], M.A. Khan[1], A. Maqbool[2], M. Avais[1], M.Younus[3], A. I. Aqib[1], I. Ahmad[1] and M. Ijaz[1*]

[1]Department of Clinical Medicine and Surgery, University of Veterinary and Animal Sciences, Lahore, Pakistan
[2]Department of Parasitology, University of Veterinary and Animal Sciences, Lahore, Pakistan
[3]Department of Pathology, College of Veterinary and Animal Sciences, Jhang, Pakistan
*Corresponding author: mijaz@uvas.edu.pk

ABSTRACT

Cysticercosis is an infection of muscles in cattle and buffaloes, which occurs due to the larval stage of *Taenia saginata.* Cysticercosis has worldwide distribution but is more common in developing countries due to poor hygienic measures. Hematological and biochemical tests may be used as alternate for the diagnosis of cysticercosis within the local setting. The present study was aimed to investigate hematological and serum biochemical changes in cysticercosis infested cattle and buffaloes. For this purpose, 60 cysticercosis seropositive animals (n=30 buffaloes; n=30 cattle) and 60 cysticercosis seronegative animals (n=30 buffaloes, n=30 cattle) based on ELISA were used. These animals were selected from private abattoir from November 2012 to October 2013. Blood and serum sample were collected from these animals and were tested for hemogram and serum biochemical profile using automated hematology and biochemistry analyzers, respectively. The results showed a significant ($P<0.05$) decrease in hemoglobin and platelet count while other hematological parameters like RBCs, WBCs, MCV, MCH and MCHC remained non-significant ($P>0.05$). Among serum biochemistry characters, minerals and glucose did not differ significantly ($P>0.05$). Significant decrease ($P<0.05$) was observed for total serum protein, cholesterol, and aspartate transaminase enzyme in infested animals. It was concluded that cysticercosis has deleterious effects on hemogram and serum biochemical profile of cattle and buffaloes.

Keywords: Cysticercosis; bovine; hematological; cholesterol; serum protein.

INTRODUCTION

Cysticercosis is an infection of muscles of cattle and buffaloes caused by larval stage of *Taenia saginata* (Hancock *et al*. 1989). The disease has worldwide distribution (Minozzo *et al*. 2002) in animals and humans with prevalence differences (Doyle *et al*. 1997). The occurrence of cysticercosis in humans is more in developing countries due to poor hygienic measures and consumption of rare or inadequately cooked or sun-cured meat (Frolova, 1982; Symth, 1994; Minozzo *et al*. 2002). The disease is also a problem in developed countries where considerable undercooked beefsteak (a beef dish) is eaten as a meal. It is of worth mentioning that even the high level of meat examination in abattoirs of developed countries has not succeeded in eliminating this parasite (Frolova, 1982; Symth, 1994; Carlos *et al*. 2003).

Cysticercosis in human is associated with symptoms of restlessness, vomiting, gastroenteritis and abdominal pain, excessive or lack of hunger, weakness, loss of weight and intestinal obstruction (Neva and Brown, 1994). Rarely, there is a serious disorder like appendix and biliary tract infestation due to mobile gravid segments. There are no symptoms in live cattle suffering from cysticercosis; however, there may be myocarditis or heart failure due to heavy infestation by the larvae (Gracey and Collins, 1992). At present no ante-mortem testing is available at abattoirs to diagnose cysticercosis in live animals, hence the diagnosis is totally based on postmortem examination of the carcass. The available tests (ELISA) are time consuming, expensive and not easily available. Thus the development of some suitable tests that are capable of identifying infected animals before slaughter is helpful for diagnosis. The tests contribute to identify the source and may help in control of the disease. Hematological and biochemical tests may be used as alternate for the diagnosis of *Cysticercus bovis* within the local setting and to qualify animals for international export with an acceptable degree of confidence (Wrights, 1998). This paper describes the changes induced in hemogram and serum biochemistry due to cysticercosis in cattle and buffaloes.

MATERIALS AND METHODS

The study was conducted on 60 cysticercosis seropositive animals (n=30 buffaloes; n=30 cattle) and 60 cysticercosis seronegative animals (n=30 buffaloes, n=30 cattle) based on ELISA in order to evaluate hematology and serum biochemistry levels. These animals were selected from private abattoir from November 2012 to October 2013.

Hematology: To compare the hematological parameters viz. hemoglobin concentration (Hb), packed cell volume

(PCV), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC), jugular vein drawn blood samples were utilized. Five mL blood from each animal using a disposable 18G sterilized hypodermic needle was dispensed into heparinized (green toped) vacutainer (Chengdu Rich Science Industry Co. Ltd. China) and labelled with identity code of the animal. The blood sample transportation and storage observed cold chain, and processing carried out within 24 hours using an automated hematology analyzer at University Diagnostic Laboratory, University of Veterinary and Animal Sciences, Lahore, Pakistan.

Serum Biochemistry: Blood samples (5mL) drawn aseptically from jugular vein of each animal were allowed to clot in clean and dry tubes, which subsequently were centrifuged for harvesting of serum. The serum samples were stored at 4°C and analyzed within 48 hours for alanine aminotransferase (ALT), aspartate transaminase (AST), alkaline phosphatase (ALP), cholesterol, total protein, albumin, urea, glucose, creatinine, Ca, K, Na and phosphorus. The biochemistry analyzer at University Diagnostic Laboratory, University of Veterinary and Animal Sciences, Lahore was used to analyze serum samples.

Statistical Analysis: The data were tested statistically using student's independent t-test. The probability level of $P<0.05$ was considered as statistically significantly different. A statistical software "SPSS13.00" was used for statistical analysis.

RESULTS AND DISCUSSION

In the present study there were significant (($P<0.05$) differences in hemoglobin and platelet count between cysticercus seropositive and seronegative of both species. The parameters other than afore mentioned did not show significant difference (($P>0.05$) among normal and cysticercus infested animals (Table 1). The non-significant difference of hematological parameters like WBC, PCV, MCV, MCH and MCHC values are in line with the findings of Kandil *et al*. (2012a) who proved same for RBCs and WBCs in non-infested and infested groups while contradicted with respect to PCV percentage and hemoglobin. However, above mentioned parameters did not go beyond their normal range in healthy and cysticercus infested ones. Moreover, when compared the hematological parameters between cattle and buffaloes (cysticercus positive and negative), the difference was non-significant ($P>0.05$).

The serum biochemistry showed most of the parameters differing at significant level ($P<0.05$) whereas sodium, potassium, calcium and glucose were non-significant ($P>0.05$) among infested and non-infested buffaloes and cattle (Table 2). Significantly lower values of total serum proteins ($P<0.05$) of infested animals (buffalo/cattle) is attributable of decreased levels of albumin compared to non-infested animals. These findings are in agreement with decreased albumin levels in calves experimentally infected with *T. saginata* (Gallie and Sewell, 1974; Evranova and Mosina, 1965). Results of the present study described significant decrease ($P<0.05$) in AST while ALT levels increased. Large number of *Cysticercus bovis* may cause hepatic dysfunction (Scandrett *et al*. 2009). The decrease in the activity of AST in infected cattle may be due to the massive number of cysts and subsequent chronic destruction of hepatic parenchyma (Pinzani and Rombonts, 2004; Otto *et al*. 2010). Similarly, urea levels were significantly lower ($P<0.05$) and those for creatinine significantly higher ($P<0.05$) in diseased animals compared to healthy ones. These findings are in agreement with those of Kandil *et al*. (2012b) who reported significantly ($P<0.05$) increased creatinine level in serum of highly infested cattle compared to non-infested ones. Decreased levels of serum urea are possibly due to hepatic damage in animals, hence a decreased capacity of the liver to convert ammonia to urea. The cholesterol level in cysticercosis infested cattle and buffaloes was significantly lower ($P<0.05$) compared to that of healthy ones. Decreases in cholesterol could be due to the role that cholesterol plays in pathogenesis by enabling the larvae to stay alive in host tissues or due to disruptions in hepatic functions and alterations in the hormonal secretion provoked by the presence of parasites. Moreover, cholesterol was found augmenting the survival of ascariasis larval growth when added to RPMI-1640 culture medium and there may be some factors or enzymes which allow the parasite to breakup and consume lipids/cholesterol (Urban *et al*.1984; Wiedermann *et al*. 1991). This usages of cholesterol in infested animals might have decreased it significantly ($P<0.05$) compared to that in non-infested animals. In addition, it was noticed that almost all the parameters whether for hemogram or serum did not transcend normal ranges of their species specific values. In conclusion, cysticercosis has deleterious effects on hemogram and serum biochemical profile in cattle and buffaloes, and testing these parameters can be used as an alternate test for the diagnosis of cysticercosis.

Table 1. Effect of *Cysticercus bovis* infestation on hematological indices of cattle and buffaloes

Parameters	Cattle		Buffaloes		Normal ranges (Kahn and Line, 2010)
	Healthy (n=30)	Infected* (n=30)	Healthy (n=30)	Infected* (n=30)	
Hemoglobin (g/dl)	11.73[a]	11.21[b]	12.59[A]	12.02[B]	8-15
PCV (%)	33.83[a]	33.22[a]	33.077[A]	33.418[A]	24-48
RBC ($x10^6$/uL)	6.40[a]	6.398[a]	7.65[A]	7.31[A]	5-10
WBC count ($x10^3$/uL)	8.30[a]	8.71[a]	8.59[A]	8.82[A]	4-12
Platelets ($x10^3$/uL)	228.45[a]	212.45[a]	278.44[A]	252.68[B]	50-750
MCV (fl)	55.11[a]	55.35[a]	51.45[A]	51.07[A]	40-60
MCH (pg)	17.32[a]	17.96[a]	16.5[A]	17.08[A]	11-17
MCHC (g/dl)	31.67[a]	32.31[a]	33.72[A]	34.23[B]	30-36

Values of cattle in each row bearing different superscript letter (a, b) are statistically significantly different (P<0.05)
Values of buffaloes in each row bearing different superscript letter (A, B) are statistically significantly different (P<0.05)
*positive for *Cysticercus bovis* on ELISA test

Table 2. Effect of *Cysticercus bovis* infestation on serum biochemical indices in cattle and buffaloes

Parameters	Cattle		Buffaloes		Normal ranges (Kahn and Line, 2010)
	Healthy (n=30)	Infected* (n=30)	Healthy (n=30)	Infected* (n=30)	
ALT (U/L)	11.53[a]	29.47[b]	11.53[A]	21.97[B]	6.9-35
AST (U/L)	113[a]	56[b]	98[A]	60.13[B]	78-132
ALP (U/L)	43.35[a]	48.13[b]	48.35A	51.7[B]	18-153
Albumin (g/dl)	3.04[a]	2.08[b]	3.04[A]	2.03[B]	2.8-3.9
Total protein (g/dl)	6.38[a]	4.7[b]	6.93[A]	4.86[B]	6.2-8.2
Cholesterol(mg/dl)	133.4[a]	47.11[b]	93.40[A]	43.07[B]	62-193
Glucose (mg/dl)	71.97[a]	72.34[a]	65.91[A]	65.55[A]	45-75
BUN (mg/dl)	5.57[a]	4.02[b]	5.63[A]	4.50[B]	6-27
Creatinine (mg/dl)	0.95[a]	3.23[b]	0.79[A]	4.32[B]	0.5-2.2
Na (mEq/L)	139[a]	140.1[a]	143.1[A]	140.16[A]	136-144
K (mEq/L)	5.01[a]	4.8[a]	5.11[A]	5.31[A]	3.9-5.8
Phosphorus (mg/dl)	6.76[a]	6.71[a]	7.24[A]	7.29[A]	5.6-8
Ca (mg/dl)	9.78[a]	9.59[a]	9.86[A]	9.7[A]	8-11.4

Values of cattle in each row bearing different superscript letter (a, b) are statistically significantly different (P<0.05)
Values of buffaloes in each row bearing different superscript letter (A, B) are statistically significantly different (P<0.05)
*positive for *Cysticercus bovis* on ELISA test

REFERENCES

Kahn C.M., and S. Line (2010). The Merck Veterinary Manual. 1oth Ed. Merck & Co., Inc. Whitehouse station, N.J., USA. pp. 2824-2827.

Carlos E., A. Nari, and W. Amanfu (2003). *Taenia solium* cysticercosis/ taeniosis. Potential linkage with FAO activities; FAO support possibilities. Acta Tropica. 87:145-148.

Doyle M., L. Beuchat, and T. Montaville. (1997). Food Microbiology. Fundamentals and Frontiers. Center for Food Safety and Quality Enhancement. Department of Food Science and Technology, University of Georgia. Washington D.C., USA.

Evranova V.G., and S.K. Mosina (1965). An electrophoretic picture of serum protein in experimental echinococcosis of sheep and cysticercosis of cattle. Materialy Nauctmoi Konferentsii Vsesoyuznogo Obshchestva Gelmintologov. 4: 327-330.

Frolova A. (1982). Epidemiology of Taeniasis. Zoonoses Control Collection of Teaching Aids for International Training Course, V.II, Moscow.

Gallie G.J., and M.M.H. Sewell (1974).The serological response of three month old calves to infection with *Taenia saginata* (*Cysticercus bovis*) and their resistance to reinfection Trop. Anim. Hlth. Prod. 6:163-171.

Gracey J.F., and D.S. Collins (1992). Meat Hygiene. W.B. Saunders Company Ltd. Philadelphia, USA. pp. 669-678.

Hancock D., S. Wikse, A. Lichtenwalner, R. Wescott, and C. Gay. (1989). Distribution of bovine

cysticercosis in Washington. Am. J. Vet. Res. 50:564-570.

Kandil O.M., S.M. Nasr, M.S. Mahmoud, S.A. Nassar, T. El-Metanawey, M.A. El-Aziz, N.M.A. El Ezz (2012b). Serological and biochemical studies on cattle naturally infested with cysticercosis. Global Veterinaria. 9:571-579.

Kandil O.M., M.S. Mahmoud, H.A. Shalaby, A.H. El Namaky, S.H.M. Hendawy and M.I.Arafa (2012a). Value of *Taenia saginata* crude antigen in diagnosis of bovine cysticercosis with reference to its characterization. Global Veterinaria. 9: 474-478.

Minozzo J.C., R.L.F. Gusso, E.A.D. Castro, O. Lago and V.T. Soccol (2002). Experimental bovine infection with *Taenia saginata* eggs: recovery rates and cysticerci location. Brazilian Arch. Biol. Tech. 45: 451-455.

Neva A.F., and W.H. Brown (1994). Basic Clinical Parasitology. 6th Ed. Prentice-Hall International Inc. New Jersey, USA. pp. 181–200.

Otto M.A., A. Da Silva, S.P. Wolkmer, C.K. Traesel, C. Schmidt, Tonin, A.A.R.A. Zanette, R.A. Lopes, S.T.A. and S.G. Monteiro (2010). Levels of liver enzymes and urea in rats naturally infected with larval forms of *Taenia taeniformis*. Comp. Clin. Pathol., 19: 527-529.

Pinzani M. and K. Rombonts (2004). Liver fibrosis: from the bench to clinical targets. Dig. Liver Dis. 36: 231-242.

Scandrett B., S. Parker, L. Forbes, A. Gajadhar, P. Dekumyoy, J. Waikagul and D. Haines 2009. Distribution of *Taenia Saginata* Cysticerci in tissues of experimentally infected Cattle. Vet. Parasitol. 164:223-31.

Symth J.D. (1994). Introduction to Animal Parasitology. 3rd ed. Cambridge University Press, New York, USA.

Urban J.F., F.W. Douvres and S. Xu (1984). Culture requirement of *Ascaris suum* larvae using a stationary multi-well system: increased survival, development and growth with cholesterol. Vet. Parasitol. 14:33-42.

Wiedermann U., H. Stemberger, E. Unfried, K. Widhalm, M. Kundli, M. Altenriederer, M. Savedra, and G. Wiedermann (1991). Intestinal worm burden and serum cholesterol or lipid concentration in a Shipibo population (Peru). Zentrabl Bakteriol. 275:279-86.

World Health Organization (1996). Investing in health research and development. Report of the Ad Hoc Committee on Health Research Relating to Future Intervention Options, Geneva. WHO.

Wrights P.F. (1998). International Standards for Test Methods and Reference Sera for Diagnostic Tests for Antibody Detection. Rev. Sci. Tech. 17:527-49.