Research Journal of

Parasitology

ISSN 1816-4943

Academic
Journals Inc.

www.academicjournals.com

Research Journal Parasitology 3 (2): 67-70, 2008
ISSN 1816-4943

A Comparative Study on Copper, Zinc, Cobalt and Iron Concentration in Hydatid Cyst (Fertile and Infertile) Fluid, Liver and Sheep Serum

[1]G.A. Kojouri and [2]H. Moshtaghi
[1]Department of Clinical Sciences,
[2]Department of Food Hygiene, Faculty of Veterinary Medicine,
Shahrekord University, Shahrekord, Iran

Abstract: The aims of present research were to determine the concentration of micro minerals, including Cu, Zn, Co and Fe in hydatid cyst fluid, comparing micro minerals composition between fertile and infertile cysts and determining the correlation between values in cysts, serum and liver tissue. A total of 2,550 slaughtered sheep were examined carefully for hydatid cyst infection. Blood samples, hydatid cysts fluid and liver samples were taken from 100 infected sheep and gravidity was diagnosed in aid with microscopic examination. Potentiometric Striping Analyzer (PSA) and atomic absorption spectroscopy were used for measuring the micro minerals concentration as well. Results showed that the concentration of mentioned micro minerals in gravid cyst fluid and its related sheep serum were significantly higher than that non-gravid ones. So, a significant and positive correlation between some micro minerals (zinc, cobalt and iron) concentration of gravid cyst fluid and related sheep serum was observed too ($p<0.05$).

Key words: Hydatid cyst, sheep, micro minerals

INTRODUCTION

Hydatid disease is a problem in many parts of the world particularly in rural communities. Echinococcosis is an infectious disease of food animals and human caused by the larval (metacestode) stage of the cestode species, *Echinococcus granulosus* (cystic echinococcosis or hydatid disease) (Gottstein, 1992; Morakote *et al*., 2007). The final/intermediate cycles of *E. granulosus* include: dog/sheep; dog/horse; dog/cattle; dog/pig; dog/reindeer and wallaby/dingo (Eckert and Thompson, 1988). Cystic echinococcosis (hydatidosis) produces clinical disease in human and economical losses to the livestock industry. The larva dwells in the viscera of intermediate hosts; it has the form of a fluid-filled cyst, bounded by a cyst wall. The hydatid fluid contains host proteins as well as parasite excretion/secretion products. The cyst wall comprises an innermost germinal layer of live parasite tissue, which synthesizes an outer, carbohydrate-rich laminated layer. The latter structure is unique to the genus *Echinococcus* and its biosynthesis represents a major metabolic activity of the germinal layer; it plays a key role in the establishment and persistence of infection by preventing the access of host cells to the live parasite. The germinal layer also gives origin, through budding towards the interior of the cyst, to the larval worms or protoscoleces. These stages are capable of infecting dogs and maturing to adult worms; for this reason, the cysts containing protoscoleces are said to be fertile or gravid (Thompson, 1995). Determining the requirement of parasite to micronutrient and the effect of cyst (fertile and infertile) on copper, zinc, cobalt and iron status in sheep infected naturally with *Echinococcus granulosus* were mentioned in this research.

Corresponding Author: H. Moshtaghi, Department of Food Hygiene, Faculty of Veterinary Medicine, Shahrekord University, Saman Road, P.O. Box 115, Postal Code 88186, Shahrekord, Iran

MATERIALS AND METHODS

This research was conducted from March 2006 to June 2007 on 2,550 slaughtered sheep. Blood samples were taken before slaughtering and cyst fluid with liver samples were collected from infected sheep. At laboratory, cyst fluids were centrifuged for detecting hydatid sands by microscopic examination. Finally, 50 fertile and 50 infertile cysts were diagnosed. Liver and blood samples were also collected from 50 healthy sheep to compare the data. The concentration of copper, zinc and iron were measured by atomic absorption spectroscopy Analytical methods for atomic absorption spectroscopy (Perkin-Elmer, 1981b) Atomic Absorption Spectroscopy (AA or AAS) is one of the commonest instrumental methods for analyzing for metals and some metalloids and cobalt concentration by Potentiometric Striping Analyzer (PSA) (Baldwin and Marshall, 1999). The data were analyzed by using 1-Way Analysis of Variance (ANOVA) for comparing micro minerals concentration between fertile and infertile cysts and also between serum and liver samples of infected sheep. For determining the relationship between micro minerals concentration in cysts and serum or liver the Pearson Correlation were used at the level of $p<0.05$ (Sigma Stat for windows, version 2.1).

RESULTS AND DISCUSSION

The concentration of copper, zinc, cobalt and iron in fertile cyst were significantly higher than that infertile cyst ($p<0.001$). These data were analyzed by using ANOVA with aid of supplemental tests such as Tukey and Dunnet at the level of $p<0.001$ (Table 1). Measuring the mentioned micro minerals in serum showed a significant differences between values in serum of sheep that affected by fertile cyst compared to infertile ones (Table 2). The concentration of these micro minerals in serum of former sheep (affected by fertile cyst) was significantly higher than that later ($p<0.001$). The correlation of micro minerals concentration in cysts and also in serum of sheep was carried out by using Pearson correlation test with aid of Tukey test. Results showed that a positive and significant correlation exists between zinc and iron concentration in fertile cyst fluids ($r = +0.345$, $p = 0.0294$) and between serum concentration of zinc and cobalt ($r = +0.328$, $p = 0.0388$) in sheep with fertile cyst. Liver concentration of copper, zinc, cobalt and iron in healthy and naturally affected sheep with hydatidosis were measured are shown in Table 3. The data showed that liver concentration of copper was significantly lower and zinc concentration was higher than that healthy sheep ($p<0.05$).

Table 1: Comparison of Cu, Zn, Co and Fe concentration in fertile and infertile hydatid cysts of sheep

Sample	Copper ($\mu g\ dL^{-1}$)	Zinc ($\mu g\ dL^{-1}$)	Cobalt ($\mu g\ dL^{-1}$)	Iron ($\mu g\ dL^{-1}$)
Fertile cyst	69.15±2.91*	44.02±2.25*	60.86±4.11*	56.23±2.19*
Infertile cyst	57.44±3.10	37.08±2.44	48.68±3.65	49.22±2.26

*: $p<0.001$

Table 2: Comparison of Cu, Zn, Co and Fe concentration in serum of sheep affected by fertile and infertile hydatid cysts

Serum sheep	Copper ($\mu g\ dL^{-1}$)	Zinc ($\mu g\ dL^{-1}$)	Cobalt ($\mu g\ dL^{-1}$)	Iron ($\mu g\ dL^{-1}$)
Infected by fertile cyst	124.46±4.92*	117.01±6.32*	79.33±1.68*	206.69±5.76*
Infected by infertile cyst	106.66±5.39	93.25±6.47	72.97±1.37	187.96±6.01

*: $p<0.001$

Table 3: Concentration of Cu, Zn, Co and Fe in liver samples of sheep affected by hydatid cysts

Liver sheep	Copper (ppm)	Zinc (ppm)	Cobalt (ppm)	Iron (ppm)
Infected	163.10±62.60*	133.75±48.62*	142.69±23.86	69.73±11.05
Healthy	190.60±53.80	82.92±40.17	138.40±25.05	74.48±20.12

*: $p<0.05$

Table 4: Schematic form of micro minerals concentration in different samples

Samples	Type of cysts	Micro minerals concentration (μg dL^{-1})
Cyst fluid	Fertile	Cu > Co > Fe > Zn
	Infertile	Cu > Fe > Co > Zn
Sheep serum	Affected by fertile	Fe > Cu > Zn > Co
	Affected by infertile	Fe > Cu > Zn > Co

The amount and proportion of mineral elements in all animal tissues varies widely. Four broad types of function for minerals exist; structural, physiological, catalytic and regulatory. These biological functions are important, but in the second quarter of the 20th century minerals have been found to regulate cell replication and differentiation; for example, calcium influences signal transduction and zinc influences transcription, adding to long-established regulatory roles, such as that of the element iodine as a constituent of thyroxin. Minerals can act as catalysts in enzymatic and hormonal systems, as integral and specific components of the structure of metalloenzymes or as less specific activators within those systems (Underwood and Suttle, 1999). Hydatid cyst fluid is clear or pale yellow, has a neutral pH and contains sodium chloride, proteins, glucose, ions, lipids and polysaccharides. The fluid is antigenic and may also contain scolices and hooklets. In present research the concentration of copper in fertile and infertile cyst fluids and iron in their related sheep serum were higher than that other mentioned micro minerals (Table 4). However, Sultan Sheriff *et al*. (1984) have showed that the concentration of zinc in hydatid cyst fluid is higher than that others; Sr, Cu, Fe, Cd, Ni, Cr and Co (Sultan Sheriff *et al*., 1984). The serum and cyst fluid levels of selenium, zinc and copper in patients and sheep with hydatid cysts were investigated earlier. They reported there is a decrease in Se and Zn and a rise in Cu in sera of patients with hydatid disease. Similar results were reported in infested sheep as related to the healthy control animals (Ozen *et al*., 1992). But based on our study the concentrations of four mentioned micro minerals in sheep sera that affected by fertile hydatid cyst were higher than that sheep with infertile cyst. To this view, sheep hydatidosis may alter micro minerals status and raise their serum concentration. Copper and zinc in liver of sheep that affected by hydatid cyst were lower and higher than that healthy sheep, respectively. These findings showed a negative effect of hydatidosis on hepatic copper concentration, that is a major site for copper reserving. Due to this hydatidosis could increase the copper concentration of serum via liver copper depletion and may interfere with determining the normal blood copper level in epidemic areas. On the other hand, gravid cysts need more copper for their growth and binding the drug (Scolecidal) with copper may enhance its efficacy.

REFERENCES

Baldwin, D.R. and W.J. Marshall, 1999. Heavy metal poisoning and its laboratory investigation. Ann. Clin. Biochem., 36: 267-300.

Eckert, J. and R.C.A. Thompson, 1988. *Echinococcus* strains in Europe. Trop. Med. Parasitol., 39 (1): 1-8.

Gottstein, B., 1992. Molecular and immunological diagnosis of echinococcosis. Clin. Microbiol. Rev., 5 (3): 248-261.

Morakote, N., K. Thamprasert, B. Lojanapiwat and M. Muttarak, 2007. Cystic echinococcosis in Thailand with a special note on detection by serology in one family. Southeast Asian J. Trop. Med. Public Health, 38 (5): 796-798.

Ozen, N., C. Celik, K. Ozkan, Z. Malazgirt, A. Isimer and A. Sayal, 1992. Trace elements in hydatid disease. J. Trace Element Electrolytes Health Dis., 6 (2): 67-70.

Perkin-Elmer, 1981. Analytical Methods for Atomic Absorption Spectroscopy Using the MHS Mercury Hydride System. Publication No. 309.

Sultan Sheriff, D.F.K. Dar and S.A. Kidwai, 1984. Metallic elements in hydatid fluid. J. Helminthol., 58 (4): 335-356.

Thompson, R.C.A., 1995. Biology and Systematics of *Echinococcus*. In: Biology and Systematics of *Echinococcus*, Lymbery, A.J. and R.C.A. Thompson (Eds.). CAB International, Wallingford, UK., pp: 1-50.

Underwood, E.J. and N.F. Suttle, 1999. The Mineral Nutrition of Livestock. 3rd Edn. CABI Publishing, New York, USA., pp: 1-6.