

## **SOME BIOCHEMICAL STUDIES ON SERUM OF SHEEP AFFECTED WITH COENURUS CEREBRALIS**

**AMAL R. TOOS AND E. ADIB**

Animal Health Research Institute, Agricultural Research Center, Giza – Egypt

Received: 29-10-2003.

Accepted: 24-12-2003.

### **SUMMARY**

The present investigation was carried on 35 Ose-mian sheep (3years old) in Borg El-Arab, Alex-andria province, Egypt. Coenurosis syndrome was observed in 15 of them and was confirmed by finding *Coenurus cerebralis* cysts in the brains of two slaughtered sheep. The observed clinical signs were anorexia, the animal holds its head to one side and turns in circles.

Erythrogram picture of sheep showing coenurosis syndrome revealed significant decrease in haemoglobin, RBCs count, packed cell volume and mean corpuscular haemoglobin concentration together with a significant increase in the mean corpuscular volume.

Serum biochemical analysis revealed significant decrease in total proteins, albumin and A/G ratio together with slight increased serum globulins.

Serum enzyme activities of the aspartate amino-transferase (AST) and creatine phosphokinase (C.P.K.) were significantly increased. Serum li-pogram values of affected sheep showed signif-icant increase of total lipids, total cholesterol, tria-cylglycerol, high density lipoproteins (HDL), low density lipoproteins (LDL), very low density li-poproteins (VLDL), free fatty acids and phospho-lipids. Vitamins "A" and "E" were significantly decreased in sheep showing coenurosis syn-drome.

It was concluded that coenurosis is a chronic de-peletating disease that affects the general health condition and productivity of infected sheep.

---

### **INTRODUCTION**

Coenurosis is a disease caused by invasion of the central nervous system by *Coenurus cerebralis*, the larval stage of the tape worm *Taenia multi-*

ceps. Sheep become infested with *Coenurus cerebralis* after ingestion of pastures contaminated with the cestode eggs that hatch in the small intestine and invade the central nervous system via blood stream. The cyst development leads to particular neurological symptoms that usually referred to as "gid" or "staggers" and sometimes death (Soulsby, 1982 and Smith, 1996). Affected sheep shows symptoms of ataxia, head tilt, circling and hyperthesia (Skerritt and Stallbumer, 1984).

Coenurosis of sheep had been recorded repeatedly by many authors all over the world. In Egypt, Ezzat (1960) and Soliman (1961) isolated *Coenurus cerebralis* cysts from sheep brain. Hosney et al. (1972) reported that coenurus cysts were found in sheep at the western coast of Libyan desert; Behera, Tahreer and Fayoum provinces. Aly et al. (1999) recorded 4.6% infestation rate among sheep herd in one farm at Kafr El-Sheikh Governorate.

Few of the reviewed literatures dealt with the haematological and serum biochemical alterations of infested sheep, among them was Clark (1969) who recorded a drop in haemocytic parameters, serum albumin, and elevated serum globulin during coenurosis. Aly et al. (1999) reported a significant decrease in RBCs counts, haemoglobin concentration and packed cell volume together with a significant increase in the activity of serum AST, ALT and C.P.K.

The present investigation aimed at studying certain haematological and serum biochemical changes that accompanies coenurosis syndrome in the examined sheep.

## MATERIAL AND METHODS

### Samples:

Whole blood on anticoagulant and blood for serum samples were collected from 15 (3 years old) Oseman sheep showing symptoms of neurological signs, in Borg El-Arab, Alexandria Governorate. Coenurosis was confirmed by finding *Coenurus cerebralis* cysts in the brain of two slaughtered sheep showing the same given symptoms.

Similar samples were also collected from another 20 (3 years old) apparently healthy sheep under the same system of nutrition, in the same locality.

### Methods:

**Blood Samples:** were examined for haemoglobin concentration (Hb), red blood cells counts (RBC) and packed cell volume (PCV). The mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) were determined according to Schalm, et al. (1975).

**Serum samples:** were analyzed for the proteinogram values total protein, according to Hoffmann and Richterrich (1979); albumin and globulin.

Doumas et al. (1971). The serum enzyme activities for the aminotransferases (AST and ALT), were measured according to the method described by Reitman and Frankel (1957) and the creatine phosphokinase (C.P.K.) were measured according to Rosano et al. (1976).

Total lipids were measured according to the method described by Knight et al. (1972); total cholesterol, Watson (1960); triacylglycerol, Foshati and Principe (1982); free fatty acids, Schuster (1979); phospholipids, Zilvermit and Davis (1950); and the highdensity lipoproteins (HDL), low density lipoproteins (LDL) and very low density lipoproteins (VLDL), according to Lopez-Virella et al. (1977). The fat-soluble vitamins A and E were also measured according to Dann and Evelyn (1938) and Quaife and Dju (1949) respectively.

Statistical analysis of the obtained data and for computing the mean, standard error and students "t" test for significance was carried on according to Snedecor and Cochran (1976).

## RESULTS

The observed clinical signs of coenurosis are mainly nervous disorders, the sheep hold its head to one side and turn in circle. The affected sheep show signs of inappetance, depression and wanders away from the flock. Coenurus infestation was confirmed by the presence of Coenurus cerebralis cysts in the parietal regions of the cerebral hemisphere of two slaughtered sheep.

Table (1) shows the erythrogram values of sheep showing coenurosis syndrome in comparison to those of apparently healthy controls under the same system of nutrition.

Tables (2 and 3) show results of the studied serum biochemical parameters of sheep showing coenurosis syndrome in comparison to those of apparently healthy controls under the same system of nutrition.

Table (1): Erythrogram values of sheep showing coenurosis syndrome (n=15) in comparison to apparently healthy control (n=20).

Parameter	Control Sheep (n=20)	Affected Sheep (n=15)
Haemoglobin gm / dl	8.90 ± 0.20	5.67*** ± 0.12
R.B.Cs 10 <sup>6</sup> / ml	9.23 ± 0.98	6.11*** ± 0.35
P.C.V. %	34.53 ± 0.98	30.00** ± 0.85
M.C.V. Fl	37.41 ± 0.78	49.15*** ± 1.35
M.C.H. P.G.	9.63 ± 0.42	9.28 ± 0.29
M.C.H.C. gm / dl	25.75 ± 0.85	18.79*** ± 0.82

\*\* = Significant at P< 0.01

\*\*\* = Significant at P< 0.001

Table (2): Proteinogram values and certain serum enzyme activities of sheep showing coenurosis syndrome (n=15) in comparison to apparently healthy control (n=20).

Parameter	Control Sheep (n=20)	Affected Sheep (n=15)
Total proteins gm / dl	6.84 ± 0.22	5.60*** ± 0.19
Albumin gm / dl	3.38 ± 0.03	2.00*** ± 0.08
Globulins gm / dl	3.46 ± 0.03	3.60* ± 0.05
A / G Ratio	0.98 ± 0.03	0.56** ± 0.02
AST U / l	36.28 ± 0.68	43.87*** ± 1.31
ALT U / l	28.35 ± 1.75	30.19 ± 0.88
C.P.K. U / l	20.07 ± 0.65	15.46*** ± 0.53

\*\* = Significant at P< 0.01

\*\*\* = Significant at P< 0.001

Table (3): Serum lipogram, vitamin A and vitamin E values of sheep showing coenurosis syndrome (n=15) in comparison to apparently healthy control (n=20)

Parameter	Control Sheep (n=20)	Affected Sheep (n=15)
Total lipids mg / dl	384.53 ± 8.74	438.44*** ± 6.49
Total cholesterol mg / dl	148.02 ± 2.75	181.93*** ± 2.70
H.D.L. mg / dl	29.60 ± 0.58	37.47*** ± 0.71
L.D.L. mg / dl	105.80 ± 1.97	133.97*** ± 0.02
V.L.D.L. mg / dl	7.85 ± 0.29	11.26*** ± 0.83
Free fatty acids m.mol / l	2.70 ± 0.03	2.93*** ± 0.05
Triacyl glycerol mg / dl	37.11 ± 0.92	56.58*** ± 1.78
Phospholipids mg / dl	173.88 ± 2.62	195.01*** ± 2.44
Vitamin A I.U. / l	47.10 ± 1.75	40.66** ± 1.48
Vitamin E µg / dl	557.00 ± 9.98	524.00** ± 6.11

\*\* = Significant at P< 0.01

\*\*\* = Significant at P< 0.001

## DISCUSSION

The observed clinical signs of ataxia, tilting of the head and circling of affected sheep agreed with the symptoms described by Aly et al. (1999) and greatly indicated coenurosis infestation in the examined sheep. Finding *Coenurus cerebralis* cysts in the parietal regions of the cerebral hemisphere of two slaughtered affected sheep confirmed the diagnosis.

Table (1) presented significant decrease in haemoglobin, red blood cells (R.B.Cs.) counts, packed cell volume (PCV), mean corpuscular haemoglobin concentration (MCHC) together with significant increase in the mean corpuscular volume (MCV).

The observed haematological changes agreed with those reported by Clark (1969), Huss et al.

(1994) and Smith (1996); and could be attributed the chronic inflammatory changes, cellular infiltration, haemorrhage and perivascular coughing reported by Sharma et al. (1998). Existence of *Coenurus cerebralis* cysts lead to suppression of the natural defense mechanism and the cellular response of the immune system that reflect itself on the haemopoietic system and interfere with the formation and or destruction of cells that parallel with the severity of infection (Parums, 1996; Lee et al. 1996 and Kaneko et al. 1997).

Table (2) revealed significant decrease of total protein, albumin and A/G ratio among sheep with coenurosis syndrome. Such results agreed with those reported by Clark (1969) and Aly et al. (1999) and could be attributed to the albumin loss into the oedematous fluid associated with *Coenurus cerebralis* infestation (Clark, 1969).

The observed significant increase of serum globulins might be associated with the response of the immune system (Kaneko, 1989). The significantly decreased A/G ratio could be a matter of the increased serum globulins accompanied with decreased serum albumin (Kaneko, 1989).

Table (3) shows significant increases in the total lipids, total cholesterol, triacyl glycerol, free fatty acids, phospholipids and the high, low and very low-density lipoproteins.

The significantly increased lipogram values in sheep showing coenurosis syndrome might be attributed, in one part, to the strong lytic activity of *Coenurus cerebralis* cysts on brain tissues that contain 51- 54% lipids (Oser, 1979). On the other hand, the increased serum lipids could be a response for a coenurus growth factor similar to the plerocercoid growth factor reported by Phares and Carroll (1977) during plerocercoid infestation of male hamsters.

The observed significant decrease of the fat soluble vitamins (vitamins A and E) could be attributed in one part to nutritional influence (ceased food uptake) accompanied with the nervous manifestations of coenurosis syndrome. On the other hand the significant lowered serum protein (table, 2) interfere with the synthesis of a retinol binding protein necessary for the transportation of vitamins in plasma (Kaneko, 1989).

From the results of this investigation it could be concluded that *Coenurus cerebralis* (the larval stage of *Taenia multiceps*) is a chronic debilitating disease that affects the general health condition of infested sheep and is quite responsible for this problem. Parasitologic examination of dogs associated with sheep rearing is of great importance. Close contact of sheep with stray dogs must be avoided and sanitary disposal of the cysts is obligatory to prevent perpetuation of the disease into sheep farms.

## REFERENCES

- Aly, A.A.; Khattab, H. Mona; Ahmed, E.E.K. and Mohran, K.A. (1999): Clinicopathological studies on "GID" among sheep in Kafr El-Sheikh Governorate. Egypt. J. Cpm. Path. 12: 22-35
- Clark, J.D. (1969): Coenurosis in Gelada Babbon (*Theropithecus gelada*). J.A.V.M.A. 155: 1258-1263.
- Dann, L. and Evelyn, E. (1938): "Estimation of vitamin A in serum", cited in B.L. Oser (1979) p. 595.
- Doumas, B.; Watson, W. and Biggs, H., (1971): Albumin standards and measurement of serum albumin with bromo-cresol green. Clin. Chem. Acta, 31: 87-92.
- Ezzat, M.A.E. (1960): The geographical distribution and incidence of imported parasitic disease in Egypt and its bearing on the livestock production. Vet. Med. Ass., 20: 125-136.
- Fossati, P. and Principe, I., (1982): Enzymatic colorimetric determination of triacylglycerol in serum. Clin. Chem., 28: 2077.
- Hoffmann Von T.P. and Richterrich, R. (1979): die Eliminierung von Trubungan bei der Bestimmung von Plasma Proteinen. Bioch. 8: 505.
- Hosney, U. Zeinab; El-Refaii, A.H. and Selim, M.K. (1972): Studies on coenurosis in sheep. J. Egypt. Vet. Med. Ass., 34: 228-240.
- Huss, B.T.; Miller, M.A.; Crowin, R.M.; Hoberg, and O'brien, D.P. (1994): Coenurosis in a cat. J.A.V.M.A. 205: 69-71.
- Kaneko, J.J. (1989): "Clinical Biochemistry of Domestic Animals" 4th Ed. Acad. Press, USA.
- Kaneko, J.J.; Harvey, J.W. and Bruss, M.L., (1997): "Clinical Biochemistry of Domestic Animals", 5th Ed. Acad. Press, Harcourt Brace and company, San Diego, Calif., U.S.A.
- Knight, J.A.; Anderson, S. and Kurtzman, W. (1972): Chemical bases of sulfaphospho-vanillin reaction for estimating serum total lipids. J. Clin. Chem., 18: 199.
- Lee, G.R.; Forester, J.; Lukens, J.; Paraskevas, F.; Greer, J.P. and Rodgers, G.M. (1996): Wintrobe's clinical haematology Vol. I, 10th Ed. Pp. 934-935. Williams and Winkins A. Waverly company, Baltimore, Philadelphia, Tokyo.
- Lopez-Virella, M.F.; Stone, P.; Ellis, S. and Golwell, J.A. (1977): Cholesterol determination in high-density lipoproteins separated by three different methods. Clin. Chem. 23: 882-884.
- Oser, B.L. (1979): Hawk's Physiological Chemistry. 14th Ed. McGraw, Hill Book Company, New Delhi.
- Parums, D.V. (1996): Essential clinical pathology 1st Ed. Pp. 193-218. Blackwell Science Ltd. Oxford.
- Phares, C.K. and Carroll, R.M. (1977): A lipogenic effect in the intact male hamsters infected with plerocercoids of the tapeworm *Spirometra mansonioides*. J. Parasitol. 63: 690.
- Quaife, P. and Dju, E. (1949): Determination of vitamin E in serum. J. Biol. Chem., 180: 363. Cited in B. Oser (1979).
- Reitman, S. and Frankel, S., (1957): A colorimetric method for the determination of serum glutamic oxalacetic and glutamic pyruvic transaminases. Am. J. Clin. Pathol., 28: 56-68.
- Rosano, T.C.; Clayson, K.J. and Stradjord, P.E. (1976): Optimized U.V. method for the quantitative determination of creatine kinase activity in serum. Clin. Chem. 22: 1078-1086.

Schalm, O.W.; Jain, W.C. and Carroll, E.J. (1975): Veterinary haematology 3rd Ed. Lee Febiger, Philadelphia.

Schuster, Von H.G., (1979): Colorimetric method for estimation of unestrified fatty acids in serum. Z. Med. Lab. Diag., 20: 212-217.

Sharma, D.K.; Singh, N.; Tiwari, H.A. (1998): Prevalence and pathology of coenurosis in organized goat farms. J. Vet. Parasitol. 12: 30-32.

Skerritt, G.G and Stallbumer, M.E. (1984): Diagnosis and treatment of coenurosis "GID" in sheep. Vet. Res. 115: 399-404.

Smith, B.P. (1996): Large animal internal medicine 2nd Ed. Pp. 1081-1082. Mosby Year Book Inc. St. Louis Missouri USA.

Snedecor, G.W. and Cochran, W.G.(1976): "Statistical Methods". Iowa State Univ. Press, Ames, Iowa, U.S.A.

Soliman, K.N. (1961): Observations on some internal parasites of sheep. J. Arab. Vet. Med. Ass., 21: 157-175.

Soulsby, E.J.L. (1982): Helminths, arthropods and protozoa of domesticated animals. 7th Ed. Baillier Tindall, England.

Watson, D., (1960): A simple method for the determination of serum cholesterol. Clin. Chem. Acta, 5: 637-643.

Zilvermit, D.B. and Davies, A.K., (1950): Colorimetric determination of phospholipids and inorganic phosphorus. J. Lab. Med. Clin. Med., 35: 155.