

Haematological and Biochemical Disturbances Associated with *Toxocara vitulorum* Infection in Buffalo Calves

CHAUDHRY SIKANDAR HAYAT, MUHAMMAD KHALID, ZAFAR IQBAL AND MASOOD AKHTAR
Department of Veterinary Parasitology, University of Agriculture, Faisalabad-38040, Pakistan

ABSTRACT

Haematological and biochemical changes were studied in buffalo calves naturally infected with *Toxocara vitulorum*. Total erythrocyte count, Haemoglobin, packed cell volume, Mean corpuscular haemoglobin concentration and Lymphocytes decreased ($P < 0.001$); whereas, Mean corpuscular volume, Erythrocyte sedimentation rate, Total leucocyte count, eosinophils and basophils increased ($P < 0.001$) in infected calves as compared to the healthy controls. The values of phosphorus, sodium, potassium, bicarbonate, glucose and total protein decreased ($P < 0.001$); whereas, those of cholesterol, calcium, chloride, Serum alkaline phosphatase, serum glutamic oxaloacetic transaminase and serum glutamic pyruvate transaminase increased ($P < 0.001$) in infected calves as compared to healthy controls.

Key Words: Haematology; Biochemistry; *Toxocara vitulorum*; Buffalo calves.

INTRODUCTION

Toxocara (T.) vitulorum, a nematode parasite of buffalo calves, has been reported to cause heavy economic losses to the livestock industry. These losses are attributed to the disturbance in acid base and electrolytes balance in diarrhoeic calves. In most cases, moderate to severe variations had been observed in the chloride, sodium, calcium, potassium and bicarbonate levels of the serum (Baruah *et al.*, 1979). The information on haematological changes associated with *T. vitulorum* in buffalo (*Bubalis bubalis*) calves is rare. This paper describes the blood picture, biochemical constituents and enzymatic activities in the serum of *T. vitulorum* infected buffalo calves.

MATERIALS AND METHODS

Blood samples (10 ml) of buffalo calves (1-3 months of age and of either sex) confirmed (faecal examination; Soulsby, 1982) having *T. vitulorum* infection were collected aseptically from jugular vein. Each sample was divided into two aliquots, 5 ml each with and without anticoagulant using ethylene diamine tetra acetic acid (EDTA) @ 1 mg/ml of blood. The samples were processed for total erythrocyte counts (TEC), haemoglobin concentration (Hb) and erythrocyte sedimentation rate (ESR) at 1st and 24 hour as described by Benjamin (1979). packed cell volume (PCV), total leucocyte counts (TLC) and differential leucocyte counts (DLC) were also determined (Jain, 1986; Shastry, 1989). Mean corpuscular volume (MCV) and mean corpuscular haemoglobin concentration (MCHC) were calculated by the following formulae:

$$MCV = \frac{\text{Packed cell volume}}{\text{Total erythrocyte count}} \times 100$$

$$MCHC = \frac{\text{Haemoglobin}}{\text{Packed cell volume}} \times 100$$

Different elements were determined using kits i.e. inorganic phosphorus (Cat No. 10027; Human Gesellschaft Fur Biochemica and Diagnostica mbH Silberbachstra Be9. D-65232 Taunusstein, Germany), chloride (Cat No. 128; Wiener Lab, 2000-Rosario, Argentina), bicarbonate (Randox Lab., Ltd. Ardmore, Diamond Road, Antrim, U.K.), glucose (Cat No. 3100; TIL TEXAS, Lab. Inc. 5601, Bintliff, Suite 500 Houston), total protein (Wiener Lab., 2000-Rosario, Argentina), cholesterol (Human Gesellschaft Fur Biochemica and Diagnostica mbH Silberbachstra Be9. D-65232 Taunusstein, Germany); sodium, potassium and calcium by Flame photometer, serum alkaline phosphatase (SAP; Human), serum glutamic pyruvate transaminase (MPR3 487368; B.H. GmbH, Mannheim W. Germany), serum glutamic oxaloacetic transaminase (SGOT E. Merck, D-6100 Darmstadt 1 Federal Republic of Germany).

RESULTS AND DISCUSSION

Haematology. The haematological changes in *Toxocara* affected animals as compared to control have been presented in Table I. It is evident from the results that TEC, Hb, PCV, MCHC and lymphocytes decreased significantly ($P < 0.001$) in infected calves as compared to the healthy controls. The values of MCV, ESR, TLC, eosinophils and basophils increased

Table I. Different haematological values (Mean \pm SD) in healthy (n=15) and infected (n=46) buffalo calves with *T. vitulorum*

Variables	Uninfected calves	Infected calves
TEC (10^3 /cu mm)	7.18 \pm 0.63 (6.30-8.50)	5.19 \pm 0.54 (4.35-5.95)
PCV (%)	36.90 \pm 0.63 (36.60-38.10)	30.40 \pm 2.43 (27.20-34.10)
Hb (g/100 ml)	12.68 \pm 0.33 (12.00-13.50)	7.70 \pm 0.92 (6.50-9.40)
ESR (mm/1 hr)	1.52 \pm 0.09 (1.40-1.70)	2.66 \pm 0.79 (2.00-3.80)
ESR (mm/24 hr)	7.31 \pm 0.68 (6.4-8.3)	15.47 \pm 0.99 (13.7-17.4)
MCV (fL)	51.39 \pm 1.37 (44.82-58.09)	58.57 \pm 2.12 (57.31-62.52)
MCHC (g/dL)	34.36 \pm 0.97 (32.78-35.43)	25.33 \pm 1.12 (23.89-27.56)
TLC (000's/Cu.mm)	8.51 \pm 0.61 (7.80-9.70)	11.12 \pm 1.76 (8.50-13.60)
Lymphocytes (%)	59.43 \pm 1.89 (53.80-61.62)	46.53 \pm 2.14 (44.65-48.60)
Monocytes (%)	2.55 \pm 0.31 (2.48-2.51)	2.51 \pm 0.21 (2.30-2.70)
Neutrophils (%)	30.13 \pm 1.31 (27.14-33.52)	44.29 \pm 3.61 (41.59-47.32)
Eosinophils (%)	1.92 \pm 0.71 (1.71-2.27)	7.12 \pm 0.13 (6.81-7.32)
Basophils (%)	0.53 \pm 0.21 (0.40-0.72)	1.41 \pm 0.11 (1.37-1.62)

significantly ($P < 0.001$) in infected calves as compared to healthy controls.

The decrease in TEC, Hb and PCV are in accordance with the findings of Zein *et al.* (1975), Lau and Singh (1983) and Pandey and Mishra (1985) in buffalo calves. The results of current study are not in accordance with the results of Baruah *et al.* (1979) who found significant increase in TEC, Hb and PCV in buffalo calves infected with *T. vitulorum*. These higher values could be due to haemoconcentration and the loss of body fluid and electrolytes in extreme diarrhoeic and dehydrated condition. *T. vitulorum*, a parasite which normally do not suck the blood but causes anaemia in buffalo calves as has been shown in the present study. The type of anaemia was found to be macrocytic hypochromic. These results are not in accordance with the findings of Udall (1954) who found macrocytic to normocytic normochromic anemia. The hypochromic anemia in present study might be due to depletion of certain nutrients like iron, copper and vitamin B₁₂ (Coles, 1974). The absence of hypochromic changes reported by Udall (1954) could be due to early stage and lesser degree of parasitic infection where the deficiency and depletion of nutrients might not be marked enough to produce hypochromic changes. Absence of reticulocytes in the peripheral blood in his studies suggested suppression of erythropoietic activity of bone marrow which could be due to some parasitic toxins in ascariasis. In contrast, Morgan (1967) thought that macrocytosis which was found in his studies may be due to maturation defect at the bone marrow level by the deficiency of vitamin B₁₂, folic acid and cobalt required for maturation of erythrocytes.

The increase in ESR was due to the decrease in TEC which might have been due to suppression of erythropoietic activity of bone marrow by the

parasites. Insufficient compensatory haemopoietic capacity of infected animals led to increased ESR. Increase in ESR may also be due to hypoproteinemia resulting from anemia and digestive disturbances. The increase in TLC is attributed to the phagocytic role of these cells. The decrease in lymphocytes could be attributed to its supply of globulins, which is under the control of adrenocortical hormones upon lymphoid tissue and lymphocytes, resulting in increased rate of cytoplasmic budding and dissolution of cells during the disease. Moreover, the toxins produced by *T. vitulorum* may produce stress to the infected animals with significant decrease in the relative and absolute numbers of lymphocytes (Coles, 1974). The eosinophilia could be a reflection of hypersensitivity by the migration of *T. vitulorum* larvae in the tissues. These findings coincide with the results of Ershov (1956). Slight increase in basophil counts has also been reported previously due to eosinophilia (Coles, 1974). No significant difference in monocyte counts was observed between infected calves and healthy controls.

Biochemistry. The results of biochemical changes associated with *Toxocara* infection have been presented in Table II. It is evident from Table II that values of phosphorus, sodium, potassium, bicarbonate, glucose and total protein decreased significantly ($P < 0.001$); whereas, those of cholesterol, calcium, chloride, SAP, SGOT and SGPT increased in infected calves as compared to healthy controls. The results of the present study are in accordance with the findings of Zein *et al.* (1975) and Baruah *et al.* (1979). The recorded levels of inorganic phosphorus in the infected calves were contrary to the calcium levels, in an attempt to maintain a calcium/phosphorus ionic equilibrium.

The current results are, however, contrary to the findings of Zein *et al.* (1975) and Pandey and Mishra (1985) for sodium, potassium and glucose. The variation in the results could be due to the degree and duration of infection and/or diet of the animals. Decrease in serum sodium, potassium and bicarbonate may be seen in diarrhea when there is proportionally a greater electrolyte loss than water loss. The decrease might have also been resulted due to gastrointestinal disturbances caused by *T. vitulorum* which led to poor absorption of these nutrients.

Hypoproteinemia and hypoglycemia are most commonly associated with a lack of proper diet or proper absorption of dietary constituents from the intestinal tract. Lack of proper absorption of dietary constituents might have also been resulted due to gastrointestinal disturbances caused by *T. vitulorum*.

Table II. Different biochemical and enzymical values (Mean ± SD) in healthy (n = 15) and infected (n = 46) buffalo calves with *T. vitulorum*

Variables	Uninfected calves	Infected calves
Inorganic phosphorus (mg/dL)	5.40±0.12 (5.3-5.7)	5.00±0.52 (4.4-5.7)
Chloride (mEq/L)	74.00±2.35 (71-78.5)	81.32±3.49 (76-87)
Bicarbonate (mg/dL)	25.78±1.23 (24-27)	21.96±2.21 (18-25)
Glucose (mg/dL)	51.23±1.87 (48-51)	41.23±4.94 (35-51)
Total protein (g/L)	6.50±0.17 (6.3-6.81)	5.79±0.62 (5.1-6.1)
Cholesterol (mg/dL)	89.13±2.03 (87-93)	110.39±5.33 (101-117)
Sodium (mEq/L)	124.86±2.55 (121-131)	119.17±7.04 (107-122)
Calcium (mEq/L)	3.89±0.21 (3.6-4.05)	4.56±0.26 (4.3-4.8)
Potassium (mEq/L)	3.92±0.91 (3.8-4.3)	3.59±0.25 (2.9-4.1)
SAP (U/L)	49.60±7.84 (41-61)	144.00±5.84 (136-154)
SGOT (U/L)	39.44±1.11 (38-41)	64.38±12.31 (53-91)
SGPT (U/L)	16.00±3.07 (11-21)	24.60±2.94 (19-29)

Increased level of cholesterol in the present study might be due to parasitic stress in infected animals which might have resulted an increase in the output of epinephrine and corticosteroids. This increase of epinephrine and corticosteroids may be responsible for the elevation of serum cholesterol in the infected animals. The increase in the enzyme activities may be attributed to complications caused by the extensive *T. vitulorum* larval migration in the body of infected animals. In addition, there are also poisonous substances which are products of metabolism of the ascarid (volatile aldehydes of fatty acids), and substances that are formed as a result of the decomposition of dead parasites which may be hepatic toxins (Ershov, 1956).

REFERENCES

Baruah, P.K., R.P. Singh and M.K. Bali, 1979. Studies on some of the biochemical and haematological changes in buffalo calves infected with *Neoscaris Vitulorum*. *Haryana Vet.*, 18: 107-10.

Benjamin. M.M., 1979. Outline of Veterinary Clinical Pathology, 2nd ed., The Iowa State University. Press, Ames, Iowa, USA.

Coles, E.H., 1974. Veterinary Clinical Pathology. 2nd ed., W.B. Saunders Co., Philadelphia.

Ershov, V.S., 1956. Parasitology and Parasitic Disease of Livestock. State Publishing House for Agricultural Literature, Moscow.

Jain, N.C., 1986. Schalims Veterinary Haematology. Leon Febiger, Philadelphia, USA.

Lau, H.D. and N.P. Singh, 1985. Haematological changes in suckling buffalo calves naturally infected with *Neoscaris vitulorum*. *Bolethin-do-Pesquisa Centro-de-Pesqusa agro-de-Tropic, Unido EM brapa, Brazil*, 69: 5-10.

Morgan, H.C., 1967. Anemia classification and diagnosis. *Vet. Med. Small Anim. Clin.*, 62: 25-8.

Pandey, N.N. and S.K. Mishra, 1985. Clinico-biochemical and therapeutic studies on anemia associated with *Neoscaris vitulorum* in cow calves. *Indian J. Vet. Med.*, 5: 129-31.

Shastry, G.A., 1989. Veterinary Clinical Pathology. 2nd ed., CBS Publishers & Distributers (Pvt.) Ltd., Delhi, India.

Soulsby, E.J.L., 1982. Helminths, Arthropods and Protozoa of Domesticated Animals, 7th ed., pp: 765-66. The English Language Book Society and Baillier Tindal, London.

Udall, D.H., 1954. The Practice of Veterinary Medicine. 6th ed., Oxford and IBH Publication Co., New Delhi.

Zein-El-Abdin, Y., J. Mossalam and S.M. Hamza, 1975. Comparative haematological and biochemical studies on buffalo calves infected with *Neoscaris vitulorum* before and after treatment with concurent (Bayer). *Egypt J. Vet. Sci.*, 12: 143-52.

(Received 01 September 1999; Accepted 10 October 1999)