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A Clinical Study on Haemato-Biochemical Alterations in Gastrointestinal Disorders of Dogs

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Abstract

The study evaluated haemato-biochemical alterations and faecal examinations in 86 dogs, divided into three groups: healthy (n=12), gastroenteritis (n=61), and foreign body syndrome (n=13). Significant findings included lower Hb, PCV, TEC, Na, K, and Cl levels in both affected groups compared to healthy dogs. TLC, neutrophils, BUN, creatinine, TB, ALP, ALT, and AST were significantly elevated in the gastroenteritis group. Eosinophils were higher in foreign body syndrome. Parasitic eggs, particularly *Toxocara* spp. and *Ancyclostoma* spp., were prevalent in the foreign body group. These results aid in diagnostic and therapeutic decision-making for gastrointestinal disorders in dogs.

Keywords: Dogs, Gastroenteritis, Toxocariosis, Ancyclostomiasis, Haemotology, biochemical analysis

Gastroenteritis is defined as the inflammation of both gastric and intestinal mucosa exhibited by clinical signs such as vomition, diarrhoea (bloody to mucoid), anorexia, inappetence and depression (Maharathi *et al.,* 2020). The etiological agents responsible can vary from the biological agents such as virus i.e., parvovirus, coronavirus, rota virus etc. (Khare *et al.,* 2020; Rajamanickam *et al.,* 2017), bacteriasi.e., *Salmonella spp., Escherichia coli, Clostridium spp.* etc. (Turk *et al.,*1992; Rajamanickam *et al.,* 2017), endoparasitesi.e., *Ancyclostomacaninum, Dipyllidiumcaninum* etc.(Kumar *et al.,* 2001), to food allergy and drugs which can irritate the gastric and intestinal mucosa. Though the young ones are more susceptible but the occurrence of gastrointestinal disorders show no age predilection. Though haemato-biochemical parameters do not provide specific information regarding the cause of the disease but they help in narrowing down the differential diagnoses i.e., bacterial, viral etc. and help in assessing the prognosis (Goddard *et al.,* 2008; Kalli *et al.,* 2010) of the patient, and change in the treatment protocol of the patient. Thus, keeping the above points in mind the following study was undertaken to analyse haemato-biochemical observation along with faecal examination findings in dogs suffering with gastrointestinal disorders.

Materials and Methods

The present study was conducted on a total of 86 dogs which were brought to the veterinary clinical complex (VCC), Faculty of Veterinary science and Animal Husbandry, SKUAST-Jammu from September, 2021 to May, 2022. For hematobiochemical analysis, the dogs presented were divided into three groups. Group I(n=12) included the dogs which were brought for normal routine check-up or vaccination and formed the control group, group II(n=61) included the dogs which were suffering with gastroenteritis showing clinical signs of vomiting and diarrhoea and group III (n=13) included the dogs which were suffering with foreign body syndrome. For hematobiochemical analysis, about 5 ml of

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venous blood was collected either from saphenous or cephalic vein out of which 1ml was transferred to EDTA vacutainer for haematological tests and the remaining 4ml was transferred to clot activator vacutainer for serum separation. The serum was harvested after centrifuging the clotted blood at 3000 rpm for 5 mins and was then stored in -20˚C in dry clean vials for biochemical parameters estimation. Haematological parameters Viz. haemoglobin (Hb), packed cell volume (PCV), total leukocyte count (TLC), differential leukocyte count (DLC) and total erythrocytic count (TEC) were evaluated with the help of Siemens haematology auto analyser (Model ADVIA 2120i). Biochemical parameters viz. alanine amino Transferase (ALT) – U/L, aspartate amino Transferase (AST) – U/L, alkaline Phosphatase (ALP) – U/L, totalprotein (TP) – g/dL, bloodureanitrogen (BUN) – mg/dL, creatinine – mg/dL, total bilirubin (Total Bilirubin) – mg/dL, sodium (Na) – mEq/L, potassium (K) – mEq/L, chloride (CL) - mEq/Lwere estimated using Erba Mannheim Chem 7 biochemical analyser using Erba kits.

Results

Various haematological parameters (Mean ± SE) viz. haemoglobin (Hb), packed cell volume (PCV), total erythrocytic count (TEC) and total leukocytic count (TLC) in group 1, group 2 and group 3 are shown in (Table I).

Haemoglobin (g/dl) and PCV (percentage) of group 2 (10.09 ± 0.23; 32.12 ± 0.81) was significantly lower ($p<0.05$) than the mean values of Hb of group 1 (12.96 ± 0.21; 40.20 ± 0.43) and group 3 (12.58 ± 0.75, 39.75 ± 0.54).TEC of (×106 /µl) group 2 (4.76 ± 0.81) and group 3 (5.79 ± 0.16) were significantly lower ($p<0.05$) than group 1 (6.81 ± 0.22). Moreover, the TEC of group 2 was significantly ($p<0.05$) lower than that of group 3. TLC (×103 /µl) of group 2 (22.32 ± 0.58) and group 3 (18.49 ± 0.78) were significantly higher ($p<0.05$) than mean values of group 1 (12.93 ± 0.22). Moreover, the TLC of group 2 was significantly higher than that of group 3.

Differential leukocyte count (DLC) () viz. Neutrophils (%), lymphocytes (%), monocytes (%) and eosinophils (%) of group 1(n=12), group 2 (n=61) and group 3 (n=13) are depicted in (Table II). Neutrophils (percentage) of group 2 (83.84 ± 0.77) was significantly elevated ($p<0.05$) than group 1 (76.98 ± 0.50) and group 3 (77.93 ± 1 .43). Lymphocytes (percentage) of group 2 (10.93 ± 0.70) was significantly lowered ($p<0.05$) than mean value of group 1 (18.17 ± 0.51) and group 3 (16.20 ± 1.11). Eosinophils (percentage) of group 3 (1.34 ± 0.34) was significantly elevated ($p<0.05$) than mean value of group 1 (0.11 ± 0.01).

Various biochemical parameters (Mean ± SE) viz. total protein (TP), blood urea nitrogen (BUN), Creatinine (CR), total bilirubin (TB), sodium (Na), potassium (K), chloride (Cl), alkaline phosphatase (ALP), alanine amino transferase (ALT) and aspartate amino transferase (AST) of group 1 (n=12), group 2 (n=61)

Table I: Mean ± SE of haematological parameters in group 1, group 2 and group 3

Parameters	Group 1 (n=12)	Group 2 (n=61)	Group 3 (n=13)
Hb (g/dl)	12.96 ± 0.21^{b}	10.09 ± 0.23^{a}	12.58 ± 0.75^{b}
PCV (%)	40.20 ± 0.43^{b}	32.12 ± 0.81^{a}	39.75 ± 0.54^{b}
TEC (10^6/µl)	6.81 ± 0.22^{c}	4.76 ± 0.18^{a}	5.79 ± 0.16^{b}
TLC (10^3/µl)	12.93 ± 0.22^{a}	22.32 ± 0.58^{b}	18.49 ± 0.78^{c}

Note: Different a, b…. in superscript in a row denotes significant difference between groups ($p<0.05$)

Table II: Mean ± SE of differential leucocyte count (%) levels in group 1, group 2 and group 3

Parameters	Group 1 (n=12)	Group 2 (n=61)	Group 3 (n=13)
N (%)	76.98±0.50^{a}	83.84±0.77^{b}	77.93±1.43^{a}
L (%)	18.17±0.51^{b}	10.93±0.70^{a}	16.20±1.11^{b}
M (%)	4.32±0.77	4.72±0.41	4.83±0.66
E (%)	0.11±0.01^{a}	0.62±0.16^{ab}	1.34±0.34^{b}

Note: Different a, b….in superscript in a row denotes significant difference between groups ($p<0.05$)

and group 3 (n=13) are given in (Table III). TP (g/dl) of group 2 (4.90 ± 0.09) and group 3 (5.02 ± 0.10) was significantly lower ($p<0.05$) than mean value of group 1 (6.04 ± 0.19). BUN (mg/dl) of group 2 (27.55±1.44) was significantly higher ($p<0.05$) than group 1 (16.08 ± 0.84) and group 3 (16.79 ± 0.86). Creatinine (mg/dl) of group 2 (1.11 ± 0.07) and group 3 (1.07 ± 0.093) was significantly higher ($p<0.05$) than mean value of group 1 (0.61 ± 0.05). TB (mg/dl) of group 2 (0.22 ± 0.04) and group 3 (0.20 ± 0.02) was significantly higher ($p<0.05$) than mean value of group 1 (0.03 ± 0.02). Na (mEq/L) of group 2 (135.90 ± 1.47) and group 3 (135.46 ± 1.33) was significantly lower ($p<0.05$) than mean value of group 1 (147.42 ± 0.84). K (mEq/L) of group 2 (3.58 ± 0.08) and group 3 (3.38 ± 0.24) was significantly lower ($p<0.05$) than mean value of group 1 (4.60 ± 0.25). Cl (mEq/L) of group 2 (91.55 ± 1.19) and group 3 (92.92 ± 1.77) was significantly lower ($p<0.05$) than mean value of group 1 (103.15 ± 1.05). ALP, ALTand AST (U/L) of group 2 (171.50 ± 4.80; 77.56 ± 4.77; 52.95 ± 3.37) and group 3 (174.92 ± 35.94; 74.27 ± 7.84; 55.97 ± 5.03) were significantly higher ($p<0.05$) than mean value of group 1 (70.423 ± 60.53).

There was no significant difference ($p>0.05$) in presence of parasitic eggs or larvae in all the groups however the maximum number of positivity (%) i.e., 30.77 % was shown in dogs suffering with foreign body syndrome followed by the dogs with gastroenteritis. The major parasitic eggs found in faeces of dogs suffering with gastroenteritis were of Toxocara spp. and Anyclostomasppas given in (Table IV) and shown in figures 1 and 2.In both group 1 and group 2 the major parasitic eggs found were of Toxocara spp. i.e., 62.5 % (5/8) and 75 % (3/4) respectively and the rest were Ancyclostoma spp. eggs.

Discussion

The significant decrease in haemoglobin (Hb), packed cell volume (PCV) and total erythrocytic count (TEC) of dogs suffering from gastroenteritis (group 2) compared to dogs of healthy group (group 1) can be attributed to anaemia and dehydration caused by haemorrhagic gastroenteritis and gastroenteritis in general. Similar findings were reported by Khare *et al*. (2020), Biswas *et al*. (2005), Kaur *et al*. (2005), Rai *et al*. (1994) and Ramprabhu *et al*. (2002). In the study conducted by Rajamanickam *et al*. (2017), Hb (5.26±0.46), PCV (21.51±1.81) and TEC (2.71±0.13) was significantly reduced due to severe blood loss and decreased erythropoiesis due to parvo-viral infection. Maharathi *et al*. (2020) also found decrease in PCV (42.10±1.35), Hb (9.36±0.74) and TEC (6.22±0.55) as in this study due to haemorrhagic loss of intestinal villi. The mean values of haemoglobin and PCV of dogs suffering with foreign body syndrome (group 3) were non-significantly lower than the apparently healthy (group 1) but there was significant decrease of TEC (5.79 ± 0.16) in dogs suffering with foreign body syndrome (group 3) which can be attributable to the blood loss and ischemia at the site of obstruction caused by

Table III: Mean ± SE of biochemical parameters in different groups group 1, group 2 and group 3

Parameters	Group 1 (n=12)	Group 2 (n=20)	Group 3 (n=13)
TP (g/dl)	6.04±0.19^{b}	4.90±0.09^{a}	5.02±0.10^{a}
BUN (mg/dL)	16.08±0.84^{a}	27.55±1.44^{b}	16.79±0.86^{a}
CR (mg/dL)	0.61±0.05^{a}	1.11±0.07^{b}	1.07±0.09^{b}
TB (mg/dL)	0.03±0.02^{a}	0.22±0.04^{b}	0.20±0.02^{b}
Na (mEq/L)	147.42±0.84^{b}	135.90±1.47^{a}	135.46±1.33^{a}
K (mEq/L)	4.60±0.17^{b}	3.58±0.08^{a}	3.38±0.24^{a}
Cl (mEq/L)	103.15±1.05^{b}	91.55±1.19^{a}	92.92±1.77^{a}
ALP (U/L)	70.42±6.53^{a}	171.50±4.80^{b}	174.92±35.94^{b}
ALT (U/L)	42.58±3.80^{a}	77.56±4.77^{b}	74.27±7.84^{b}
AST U/L	17.00±0.66^{a}	52.95±3.37^{b}	55.97±5.03^{b}

Note: Different a, b, c…. in superscript in a row denotes significant difference between groups ($p<0.05$)

the foreign body and the subsequent anorexia. In the study conducted by Atray (2010), TEC was not calculated but Hb (10.34±0.81) and PCV (3.11±0.34) were below the reference range in dogs suffering with foreign body syndrome though not significantly different from the apparently healthy ones which was somewhat similar to this study and in the study conducted by Kaur (2012) Hb (11.38±1.49) was below the reference range whereas PCV, TEC was not calculated and was somewhat similar to our study.

There was significant increase in total leukocyte count in dogs suffering with gastroenteritis (22.32 ± 0.58) as compared to dogs of healthy group which might be attributed to secondary bacterial infections and similar findings were reported by Sharma *et al*. (2008), Sharmai *et al*. (2008). Rajamanickam et al. (2017) with TLC (14.43±0.92) attributed this increase to the stimulatory action of bone marrow in response to primary and secondary infections. Maharathi *et al*. (2020) also attributed the increase in TLC (15.23±1.03) to intravascular haemolysis damaging vital organs and from expression of bone marrow with left shift in its study. There was significant increase of TLC in dogs suffering with foreign body syndrome (18.49 ± 0.78) which might be due to immune reaction to the foreign body along with germination of secondary bacterial infections and similar findings were reported by Hobday *et al*. (2014) in both linear (16.24×10^{9}/L) and non- linear foreign body obstructions (15.60×10^{9}/L). Similarly, Kaur (2012), Singh (2019) and Atray (2010) reported elevated levels of TLC (1,78,365±3988.58), (18691±1774) and (23.62±4.52) respectively in their subsequent studies which coincided with the findings of this study.

There was significant increase of neutrophil and subsequent significant decrease in lymphocyte count in dogs suffering with gastroenteritis (83.84 ± 0.77, 10.93 ± 0.70) from

Table IV: Presence of parasitic egg or larvae (%) in group 1, group 2 and group 3

Groups	Positive %	Negative %	Chi-square	P-value
1 (n=12)	0	100 (12)	5.043	0.080
2(n=61)	13.11 (8)	86.89 (53)		
3(n=13)	30.77 (4)	69.23 (9)		

Note: Figures in parenthesis denote number of animals

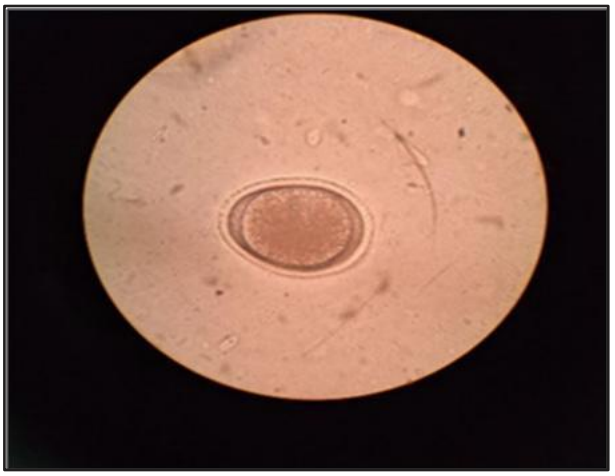

Fig 1: Ovum of *Toxocaracanis*

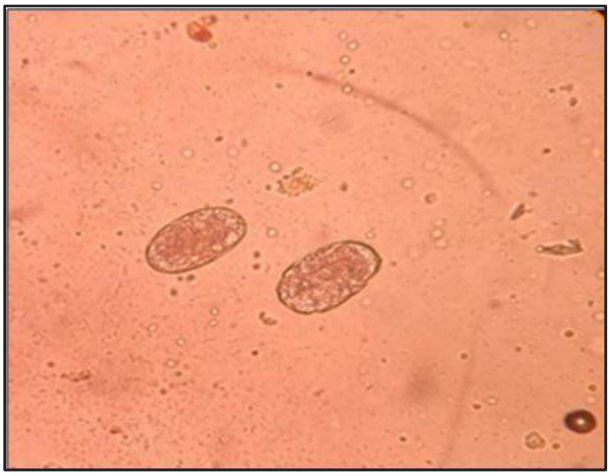

Fig 2 : Ova of *Ancyclostomumcaninum*

apparently healthy dogs which might be due to activation and expression of the immune system of the body and similar findings were reported by Maharathi *et al*. (2020), Berghoff and Steiner (2011), Ramprabhu *et al*. (2002). Khare *et al*. (2020) attributed increased neutrophils (68.50±0.58) and reduced lymphocytes (23.04± 0.40) to secondary bacterial infection and replication of virus in lymphoid organs respectively which was similar to this study. There was subsequent significant increase of eosinophils (1.34 ± 0.34) in dogs suffering with foreign body syndrome which might be attributable to secondary bacterial infection and presence of parasitic infection in these dogs. Similar findings of neutrophilia was reported by Lotlikar *et al*. (2020) in dogs suffering with mechanical obstruction and of eosinophilia in parasitic enteritis as a cause of mechanical obstruction by Southwood *et al*. (2000).

Total protein (g/dl), Na (mEq/L), K (mEq/L), Cl (mEq/L) were significantly decreased in dogs suffering with gastroenteritis (4.90 ± 0.09, 135.90 ± 1.47, 3.58 ± 0.08, 91.55 ± 1.19) due to loss of electrolytes during diarrhoea and vomition whereas BUN(mg/dl), CR(mg/dl), TB (mg/dl), ALP(U/L), ALT(U/L) and AST (U/L) were significantly increased (27.55 ± 1.44, 1.11 ± 0.07, 0.22 ± 0.04, 171.50 ± 4.80, 77.56 ± 4.77, 52.95 ± 3.37) due to pre renal azotaemia and reduced glomerular filtration rate along with lysis of hepatic and splenic cells and somewhat similar findings were reported by Maharathi *et al*. (2020); Kataria *et al*. (2020); Khare *et al*. (2020) and Rajamanickam *et al*. (2017).

Total protein (g/dl), Na (mEq/L), K (mEq/L), Cl (mEq/L) were significantly decreased in dogs suffering with foreign body syndrome (5.02 ± 0.10, 135.46 ± 1.33, 3.38 ± 0.24, 92.92 ± 1.77) respectively. Similarly, Hobday *et al*. (2014), Applewhite *et al*. (2002), Gal et al. (2007) also reported hypochloraemia, hyponatremia and hypokalaemia in their studies due to loss of electrolyte during vomition. Adamcak *et al*. (2000) reported hypoproteinaemia due to malabsorption and anorexia because of foreign body obstruction. BUN (mg/dl) CR (mg/dl), TB (mg/dl), ALP(U/L), ALT(U/L) and AST (U/L) were also significantly increased (16.79 ± 0.86, 1.07 ± 0.09, 0.20 ± 0.02, 174.92 ± 35.94, 74.27 ± 7.84, 55.97 ± 5.03) respectively. The significantly elevated BUN findings were also reported by Hobday *et al*. (2014) which might be due to drastic reduction of food intake leading to toxaemic signs. However the findings of CR, TB, ALP, ALT, AST were in contrast to that of this study They were non-significantly increased due to reduced blood supply to kidney and liver because of generalised dehydration leading to cell death of the organs involved.

The major parasitic eggs found in faeces of dogs suffering with gastroenteritis were of *Toxocara* spp. and *Anyclostoma* spp. which was also reported by Ramı rez-Barrios *et al*. (2004), Batchelor *et al*. (2008), Lorenzini *et al*. (2007) and Yu *et al*. (2018) who found their prevalence in patients present in veterinary care institutions suffering with gastrointestinal disorder which can be due to poor owners' awareness of anthelmintic regiment and compliance for deworming.

In case of dogs with foreign body, the major eggs found were of *Toxocara* spp. which might be an incriminating factor of developing aberrant feeding habits leading to pica and thereby obstruction which was also reported by Wigger *et al*. (2007) and Chawla *et al*. (2003).

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