

Leverage of Gastroenteritis on Blood and Biochemical Profile in Dogs

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Abstract

One of the most common canine maladies seen by veterinarians worldwide is gastroenteritis. The purpose of this investigation was to analyze hematological and biochemical changes in canines suffering from gastroenteritis. One hundred canines of varying ages and breeds participated in the study, with ten considered "appearing healthy" and ninety considered "diseased." A total of 200 blood samples, representing both groups, were taken for hematological and biochemical analysis. Clinical manifestations included vomiting, diarrhea that ranged from watery yellow to bloody, loss of appetite, and mild, moderate, and severe dehydration, as indicated by a STT, increased respiratory rate, and a tachycardic rate. Diseased dogs typically exhibit elevated levels of the biochemical markers AST and ALT, and decreased levels of the hematological markers Hb, PCV, RBCs, platelets, WBCs, neutrophils, lymphocytes, monocytes, total protein, albumin, globulin, sodium, calcium, chloride, potassium, and iron.

Keywords: Dogs, Gastroenteritis, hematological analysis, biochemical analysis, electrolytes

1. Introduction:

Pets like cats and dogs serve important roles in communities all over the globe. People keep pets for a variety of reasons, including

psychological, social, and physiological benefits. (*Robertson et al., 2000*). All dog breeds and ages are susceptible to gastroenteritis, the most common gastrointestinal

disease in canines. (*Bhat et al., 2015*).

Furthermore, according to *Trotman et al. (2015)*, one of the leading causes of high morbidity and mortality rates is gastroenteritis, a term used to describe inflammation of the stomach and intestinal tract. Gastrointestinal disorders can be acute or chronic, self-limiting or fatal. The physical manifestations of dehydration range from no clinically discernible alterations to indications of hypovolemic shock, which may arise from fluid loss and multiple organ failure due to inadequate tissue perfusion as mentioned by *Atata et al. (2018)*.

Gastroenteritis is a widespread challenge for veterinary clinicians due to its numerous etiologies, which include infectious and non-infectious factors. Infectious etiologies include viral, bacterial, and parasite diseases. In contrast, non-infectious causes include dietary errors, irritating medicines, the consumption of hazardous substances, immunological deficiency, and metabolic abnormalities. (*Ettinger and Feldman, 2010*) and (*Kataria et al., 2020*).

History, clinical symptoms, fecal examination, systemic evaluation including a complete blood count, biochemical testing, urinalysis, abdominal radiography, abdominal ultrasonography, biopsies of the stomach and intestine, endoscopy, and laparoscopy are frequently used

to diagnose gastroenteritis. (*Trotman et al., 2015*).

Examining dogs with gastroenteritis, collecting blood samples to estimate hematological picture, and measuring biochemical parameters in serum of clinically healthy and diseased dogs are the objectives of this study.

2. Materials and Methods

2.1. Ethical approval

All procedures used in the present study were approved by the Scientific Research Ethics Committee on animal researches, Faculty of Veterinary Medicine, Suez Canal University, Egypt (2022062).

2.2. Animals and management

This research was conducted at a private small animal clinic and a government veterinary clinic affiliated with the Directorate of Veterinary Medicine in Ismailia Governorate, Egypt, on household dogs with gastroenteritis disorders. The research was conducted from the start of June 2019 through the end of February 2021.

In this study, a total of one hundred (100) household dogs of various breeds were enrolled. All dogs were fed moist, home-prepared food such as chicken, potatoes, macaroni, eggs, beans, bread, and occasionally commercial dog food; their food did not contain any beef or chicken bones. Among the investigated dogs, ten appeared to be healthy (n=10) and served as a control group for obtaining comparison values. The

remaining investigated canines (n=90) were determined to be diseased and displayed symptoms of gastroenteritis.

A total number of 200 blood samples were transferred in an ice box within one hour of collection to the Research Laboratory of the Department of Animal Medicine, Faculty of Veterinary Medicine, Suez Canal University, Egypt. Two blood samples were taken from each dog for hematological and biochemical examinations.

2.4. Clinical Examination of the Animals:

The owner of infected dogs provided the following information: name, age, sex, breed, weight, vaccination and deworming program history, prior and current diseases and medications, type of diet, manner of feeding, and environment. History of gastrointestinal disorders including owner complaint, appetite, onset date, vomiting, and diarrhea (severity, time of onset consistency, duration, amount, and repetition along the day).

Following the protocol established by *Cote et al. (2015)* we conducted a complete investigation and clinical examination of each dog. According to *Davis et al. (2013)*, a thorough physical examination includes visual inspection, estimation of respiration and pulse rate, recording of rectal body temperature, inspection of mucous membranes, inspection of the oral cavity, nose, and ears, abdominal palpation, and the Skin

Turgor Test (STT) to assess dehydration.

2.5. Hematological picture (CBC):

Hematological parameters comprised hemoglobin concentrations (Hb), packed cell volume (PCV), red blood cell count (RBCs), blood indices such as mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), and mean corpuscular haemoglobin concentrations (MCHC), platelet count, white blood cell count (WBCs), and differential leukocytes count. Using an enhanced Neubauer hemocytometer and (Hayem's and Turkey's) as erythrocyte and leukocyte diluents respectively. According to Brar et al., 2000 blood films were stained with Geimsa dye for differential Leukocyte counting, which was accomplished manually using percentage and absolute value for neutrophils, lymphocytes, monocytes, eosinophils, and basophils.

2.6. Biochemical analysis of serum samples:

Serum samples were analyzed for a variety of biochemical and electrolyte parameters, including total protein (g/dl), albumin (g/dl), globulin (g/dl), albumin/globulin (A/G) ratio, aspartate amino transferase (U/L), alanine amino transferase (U/L), and urea and creatinine levels (mg/dl) for liver and kidney function, respectively. The levels of sodium, potassium, chloride, calcium, phosphorus, and magnesium in the serum were all

determined, and lactate (mmol/dl) was calculated as an indirect indicator for acid-base imbalance. Zinc and iron were the trace elements that were evaluated. All values were approximations based on the manufacturer's instructions for the respective kits.

2.7. Statistical Analysis:

The acquired data were statistically evaluated using the independent T-test in SPSS (version 20) for Windows; (Levesque, 2007). Utilizing Microsoft Excel, the mean values and standard error (SE) were computed.

3. Result

3.1. Clinical signs

Clinical examination of apparently healthy dogs (n=10) revealed that the mean values of rectal temperature, respiratory and pulse rate were within normal range in addition to good appetite and rosy red mucous membrane.

The most predominant clinical signs in dogs suffered from gastroenteritis (n=90) were vomiting followed by watery yellowish to bloody diarrhea, their frequency were ranged from one to seventh times daily, anorexia, as well as mild, moderate and severe degrees of dehydration represented by of STT, whereas increased respiratory and pulse rate, no evidence of abdominal pain or tenderness, mucous membrane was ranged from rosy red to pale color.

3.2. Hematological picture (CBC):

Hematological picture showed in Table (1) and revealed that there was

a highly significant decrease in the mean values of Hb, PCV, RBCs and platelets at ($P \leq 0.05$) in dogs suffered from gastroenteritis compared with the control group. Meanwhile, there was a non-significant change in the mean values of MCV, MCH and MCHC in dogs suffered from gastroenteritis compared with the control group.

A highly significant decrease in was observed the mean values of white blood cells, neutrophils, lymphocytes and monocytes at ($P \leq 0.05$). Whereas there was a non-significant change in the mean values of eosinophils and basophils at ($P \leq 0.05$) in dogs suffered from gastroenteritis compared with the control group as showed in Table (2).

3.3. Biochemical analysis:

A highly significant decrease in the mean values of TP, Albumin and globulin at ($P \leq 0.05$) were recorded in dogs suffered from gastroenteritis compared with the control group. Meanwhile a significant decrease in the mean values of A/G ratio at ($P \leq 0.05$) was recorded in dogs suffered from gastroenteritis compared with the control group as showed in Table (3).

Liver enzymes (AST & ALT) were represented in Table (3) which revealed that there is a high significant increase in the mean values of AST at ($P \leq 0.05$) in all diseased dogs compared with the control group. On other hand there was a non-significant change in the mean values of ALT at ($P \leq 0.05$)

was recorded in all diseased dogs compared with the control group.

Renal function analysis (urea & Creatinine) revealed a non-significant change in the mean values of urea at ($P \leq 0.05$) in diseased group compared with the control group, in addition to a significant increase in the mean values of creatinine at ($P \leq 0.05$) was recorded in diseased dogs compared with the control group. These results were presented in Table (3).

Table (4) revealed a significant decrease in the mean values of sodium, calcium and chloride at ($P \leq 0.05$) was recorded in dogs in diseased groups compared with the

control group. Beside a significant decrease in the mean values of potassium at ($P \leq 0.05$) was recorded in dogs suffered from gastroenteritis compared with control group. Meanwhile a non-significant change in the mean values of magnesium and lactate at ($P \leq 0.05$) was observed when compared with control group. Beside, examination of Table (4) revealed a highly significant decrease in the mean values of iron at ($P \leq 0.05$) in dogs suffered from gastroenteritis compared with the control group, meanwhile there was non-significant change in the mean values of zinc at ($P \leq 0.05$) compared with the control group.

Table 1. The mean values \pm S.E of haemogram and platelet picture in dogs suffered from gastroenteritis compared with control group.

Groups Parameters	Control (n=10)	Diseased (n=90)	P- value
Hb(g/dl)	14.16 \pm 0.46	8.39 \pm 0.4	0.000**
PCV%	41.92 \pm 1.2	28.5 \pm 1.6	0.000**
RBCs($\times 10^6/\mu\text{L}$)	3.58 \pm 0.08	2.63 \pm 0.15	0.001**
MCV(fl)	117.6 \pm 6.12	111.3 \pm 9.09	0.653 ^{NS}
MCH (pg)	39.7 \pm 2.11	32.89 \pm 2.5	0.101 ^{NS}
MCHC%	33.8 \pm 0.9	29.78 \pm 1.33	0.076 ^{NS}
Platelets $\times 10^3/\mu\text{L}$	408 \pm 25.17	315.5 \pm 12.12	0.002**

NS: Non-significant ($P < 0.05$), *: Significant ($P \leq 0.05$). **: Highly significant ($P < 0.01$).

Table 2. The mean values \pm S.E of Leucogram picture in dogs suffered from gastroenteritis compared with control group.

Groups Parameters	Control (n=10)	Diseased (n=90)	P value
WBCs($\times 10^3/\mu\text{L}$)	8.58 \pm 1.47	3.21 \pm 0.52	0.001**
Neutrophils $\times 10^3/\mu\text{L}$	4.46 \pm 0.76	1.8 \pm 0.31	0.002**
Lymphocytes $\times 10^3/\mu\text{L}$	3.27 \pm 0.54	1.17 \pm 0.18	0.001**
Monocytes $\times 10^3/\mu\text{L}$	0.65 \pm 0.12	0.18 \pm 0.02	0.000**
Eosinophils $\times 10^3/\mu\text{L}$	0.20 \pm 0.05	0.07 \pm 0.01	0.100 ^{NS}
Basophils $\times 10^3/\mu\text{L}$	0.01 \pm 0	0.2 \pm 0.13	0.20 ^{NS}

NS: Non-significant ($P < 0.05$), *: Significant ($P \leq 0.05$). **: Highly significant ($P < 0.01$).

Table 3. The mean values \pm S.E of biochemical parameters in dogs suffered from gastroenteritis compared with control group.

Parameters	Control (n=10)	Diseased (n=90)	P- value
Total Protein(g/dl)	7.17 \pm 0.15	3.6 \pm 0.15	0.000**
Albumin(g/dl)	3.45 \pm 0.07	2.79 \pm 0.14	0.008**
Globulin(g/dl)	3.71 \pm 0.1	0.84 \pm 0.13	0.000**
A.G ratio	0.93 \pm 0.02	4.33 \pm 0.8	0.011*
AST(IU/L)	8.95 \pm 0.96	21.6 \pm 1.4	0.000**
ALT(IU/L)	23.1 \pm 4.3	18.9 \pm 0.78	0.120 ^{NS}
Urea(mg/dl)	52.26 \pm 6.47	56.15 \pm 4.2	0.612 ^{NS}
Creatinine(mg/dl)	0.82 \pm 0.13	1.28 \pm 0.1	0.024*

NS: Non-significant (P < 0.05), *: Significant (P \leq 0.05). **: Highly significant (P < 0.01).

Table 4. The mean values \pm S.E of serum electrolytes and trace elements in dogs suffered from gastroenteritis compared with control group.

Parameters	Control (n=10)	Diseased (n=90)	P- value
Sodium(mEq/L)	144.5 \pm 0.65	135.47 \pm 1.25	0.000**
Potassium(mEq/L)	5.01 \pm 0.11	3.77 \pm 0.51	0.027*
Calcium(mg/dL)	1.02 \pm 0.01	0.43 \pm 0.06	0.000**
Magnesium(mg/dL)	2.86 \pm 0.36	3.3 \pm 0.41	0.507 ^{NS}
Chloride(mEq/L)	99 \pm 0.70	65.1 \pm 5.9	0.002**
Lactate(mmol/L)	6.02 \pm 0.25	7.26 \pm 0.49	0.115 ^{NS}
Iron(μ g/dl)	96.7 \pm 4.36	77.2 \pm 3.16	0.003**
Zinc(μ g/dl)	86.4 \pm 3.9	83.8 \pm 2.8	0.603 ^{NS}

NS: Non-significant (P < 0.05), *: Significant (P \leq 0.05). **: Highly significant (P < 0.01).

4. Discussion

4.1. Hematological Findings:

Hypohemoglobinemia was shown to be extremely prominent in this investigation of canine gastroenteritis. Previous research mentioned by *Abdelbaky et al. 2017* reported similar results. The Hypohemoglobinemia may be caused by a combination of factors, including dietary problems and iron shortage, loss of blood in stool due to significant sloughing of intestinal epithelial cells, and injury to the vascular epithelium of the gut that

reduces Hb concentration (*Dash et al., 2017 and Khanduri et al., 2021*).

The majority of dogs with gastroenteritis in our study exhibited a significantly substantial drop in PCV. These findings were consistent with those of *Arora et al. (2018)*, who attributed these decreases to the anemia that developed in dogs with hemorrhagic gastroenteritis.

Total erythrocyte counts were found to be significantly lower in dogs with gastroenteritis, which was consistent with the findings of *Salem et al. (2015)*, who attributed this decrease

to the oxidative stress and lipid peroxidation mechanism of tissue damage. Additionally, the observed thrombocytopenia in diseased dogs was consistent with those reported by *Kataria et al. (2020)*, which may be due to blood losses in stool.

Leukocyte, neutropenia, lymphopenia, and monocytopenia were all significantly reduced in infected dogs with hemorrhagic gastroenteritis, consistent with previous research (*Terzungwe et al., 2018*). Damage to the hematopoietic progenitor cells of various types of Leukocyte in the bone marrow and other lymphoid organs like the spleen, thymus, and lymph nodes could be responsible for the severe Leukopenia, neutropenia, and lymphopenia seen in ill dogs (*Goddard and Leisewitz 2010*).

4.2. Biochemical findings:

Hypoalbuminemia and hypoglobulinemia occur in gastrointestinal disorders that result in destruction of intestinal villi and disruption of the gastrointestinal mucosal barrier and develop a severe protein-losing enteropathy (*Tefft, 2014*), which may account for a highly significant decrease in TP in diseased dogs observed in the present study.

According to *Bhat et al. (2013)*, the highly substantial decrease in albumin values may be attributable to a decrease in dietary intake, malabsorption of protein through damaged villi, and continued protein-losing enteropathy. In gastrointestinal disorders, globulin

has been found to seep through the intestinal wall into the lumen, according to *Gorman (2011)*. This is a common symptom of intestinal problems that result in substantial hypoglobulinemia due to blood loss. Large amounts of AST are present in red blood cells, liver, heart, muscle tissue, pancreas, and kidneys, so the destruction of any of these tissues results in the release of large amounts of this enzyme into the blood, in addition to dehydration and the passage of microbes, endotoxins via portal circulation, precipitating reactive hepatopathy (*Kaneko et al., 2008 and Shima et al., 2022*). In accordance with *Xaxa and Kumar (2020)* there was also a considerable increase in the serum creatinine levels of dogs with gastroenteritis. Electrolyte abnormalities are typical in both vomiting and diarrhea due to the high electrolyte content of both fluids (*Tello and Perez-Freytes, 2017*). Our observations of hyponatremia, hypokalemia, and hypocalcaemia in ill dogs were consistent with those of *Ukwueze et al (2020)*. These effects may be attributable to electrolyte losses in diarrhoeal fluid and vomitus, as well as a decrease in food intake that contributes to symptoms of depression and weakness (*Burchell et al., 2014*). In addition, hypochloremia degree is assessed by the severity and frequency of vomiting episodes (*Tello and Perez-Freytes, 2017*).

In dogs with gastroenteritis, a drop in blood iron levels may be attributable to blood loss in the stool (*Panda et al., 2009*), while free radical damage to the intestinal absorptive surface further lowers macro- and micronutrient absorption (*Rahman et al., 2002*)

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المخلص العربي

تأثير النزلات المعوية علي الاكلينيكية، صورته الدم والكيميائية في الكلاب
نهلة مصطفى محمد ، اسماء عمر علي، خالد محمد صلاح، احمد السيد محمود

أجريت الدراسة الحالية في احدى عيادات الحيوانات الصغيرة الخاصة واحدى العيادات الحكومية التابعة لمديرية الطب البيطرى في محافظة الإسماعيلية - مصر على كلاب منزلية كانت تعاني من اضطرابات معدية معوية، منذ بداية شهر يونيو 2019 واستمرت حتى نهاية شهر فبراير 2021 اجريت هذه الدراسة على عدد مائة كلب منزلي، عشر كلاب كانت ظاهريا سليمة ولا تعاني من أى اضطرابات وكانت باقى الكلاب تعاني من اضطرابات فى الجهاز الهضمي (اضطرابات معدية معوية) كانت هناك عشرة كلاب تتمتع بصحة جيدة واستخدمت كمجموعة ضابطة وعانت بقية الكلاب من علامات التهاب المعدة والأمعاء. تم الحصول على 200 عينة دم من جميع الكلاب قيد الدراسة (عينتان لكل كلب واحدة لفحص الدم والاخرى للتحليل الكيميائي الحيوي).

تم الحصول على التاريخ التفصيلي للكلاب المريضة بما في ذلك الاسم والعمر والجنس والسلالة والوزن وتاريخ التطعيم وبرنامج التخلص من الديدان والأمراض السابقة والحالية والأدوية ونوع النظام الغذائي وطريقة التغذية والبيئة.

تشمل عناصر الفحص: الفحص العام، وتقدير التنفس والنبض، وتسجيل درجة حرارة الجسم من المستقيم، وفحص الأغشية المخاطية، وفحص تجويف الفم والأنف والأذنين، وجس البطن واختبار تورم الجلد (STT) لتقييم درجة الجفاف. اشتملت عناصر فحص الدم على: الهيموجلوبين، حجم الخلايا المضغوطة، مجموع كرات الدم الحمراء، مؤشرات الدم مثل (متوسط قياس حجم كريات الدم الحمراء، متوسط كمية الهيموجلوبين الموجود في خلية دم حمراء واحدة، تركيز الهيموجلوبين في حجم معين من خلايا الدم الحمراء، الصفائح الدموية، مجموع كرات الدم البيضاء، الخلايا متعادلة الصبغة، الخلايا الليمفاوية، وحيدات الخلية، الخلايا حمضية الصبغة، الخلايا قاعدية الصبغة).