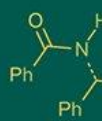


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Gaddam Tejeswar

M.V.Sc. Research Scholar,
Department of Veterinary
Medicine, College of Veterinary
Science, Proddatur, Sri
Venkateswara Veterinary
University, Tirupati, Andhra
Pradesh, India

Devarakonda Srikala

Associate Professor and Head,
Department of Veterinary
Medicine, College of Veterinary
Science, Garividi, Sri
Venkateswara Veterinary
University, Tirupati, Andhra
Pradesh, India

Pagadala Revathi

Assistant Professor,
Department of Veterinary
Medicine, College of Veterinary
Science, Proddatur, Sri
Venkateswara Veterinary
University, Tirupati, Andhra
Pradesh, India

Vutharamalluru Gnani Charitha

Associate Professor and Head,
Department of Veterinary
Parasitology, College of
Veterinary Science, Proddatur,
Sri Venkateswara Veterinary
University, Tirupati, Andhra
Pradesh, India

Corresponding Author:**Gaddam Tejeswar**

M.V.Sc. Research Scholar,
Department of Veterinary
Medicine, College of Veterinary
Science, Proddatur, Sri
Venkateswara Veterinary
University, Tirupati, Andhra
Pradesh, India

Haematological and Biochemical Alterations Associated with Naturally Occurring Gastrointestinal Parasitic Infections in Dogs and Their Therapeutic Response

Gaddam Tejeswar, Devarakonda Srikala, Pagadala Revathi and Vutharamalluru Gnani Charitha

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Abstract

A total of 604 dogs presented to the Veterinary Clinical Complex were screened for gastrointestinal parasitic infections by fecal examination. Among them, 314 dogs (51.99%) were found positive for gastrointestinal parasites and were included in the present investigation, while 12 apparently healthy dogs served as controls for haematological and biochemical comparisons. The positive dogs were evaluated clinically and subjected to haematological, serum biochemical and fecal egg count (EPG) examinations before and after treatment. The most common clinical signs observed were anorexia, diarrhoea, weakness, vomiting and pale mucous membranes. Significant reductions ($P \leq 0.05$) in haemoglobin, total erythrocyte count, packed cell volume, total protein and albumin were recorded, whereas total leukocyte count, neutrophil count, eosinophil count and liver enzyme activities (ALT, AST and ALP) were significantly increased. Treatment with fenbendazole and praziquantel, selected according to the type of gastrointestinal parasitic infection, resulted in marked clinical improvement, significant improvement in haematological and biochemical parameters, and a pronounced reduction in fecal egg shedding, with complete elimination of detectable parasite eggs in the majority of infected groups and a near-complete reduction in mixed nematode-cestode infection by Day 21. The study demonstrates that gastrointestinal parasitic infections produce significant systemic alterations in dogs and highlights the importance of routine fecal examination, haematological and biochemical evaluation for diagnosis, prognosis and monitoring of therapeutic response.

Keywords: Canine, gastrointestinal parasites, haematology, serum biochemistry, fenbendazole, praziquantel, therapeutic efficacy

1. Introduction

Gastrointestinal (GI) parasitic infections are among the most prevalent diseases affecting dogs worldwide and continue to pose significant veterinary and public health concerns. Dogs of all ages are susceptible to infection; however, puppies and immunocompromised animals are particularly vulnerable due to their immature or weakened immune systems. The most frequently encountered gastrointestinal parasites include *Toxocara canis*, *Ancylostoma caninum*, *Trichuris vulpis*, *Toxascaris leonina*, *Dipylidium caninum* and other cestodes and protozoa. These parasites adversely affect canine health by causing enteritis, anemia, malnutrition, reduced growth, poor body condition and, in severe infections, death. Bowman (2021) [19] and Taylor *et al.* (2016) [3] described gastrointestinal parasitism as one of the leading causes of morbidity in companion animals because of its impact on nutrient utilization, intestinal integrity and overall health.

Several canine gastrointestinal parasites possess considerable zoonotic importance. Traversa (2012) [9] emphasized that *Toxocara canis* and *Ancylostoma caninum* are responsible for human toxocariasis and cutaneous larva migrans, respectively, making regular parasite control an important public health measure. Similarly, Overgaauw and van Knapen (2013) [10] reported that environmental contamination with infective eggs and larvae from untreated dogs contributes significantly to human exposure. Therefore, routine deworming, proper sanitation and regular fecal examination are recommended by the European Scientific

Counsel Companion Animal Parasites (ESCCAP, 2021) [7] and the Companion Animal Parasite Council (CAPC, 2023) [8] for effective parasite control.

The prevalence of canine gastrointestinal parasites varies considerably depending on geographical location, climatic conditions, age, management practices and deworming status. Warm and humid environments favour the survival of infective stages in the environment, resulting in continuous transmission among susceptible dogs. Little *et al.* (2009) [13] reported a high prevalence of intestinal parasites in pet dogs, while Ballweber *et al.* (2014) [14] emphasized that inadequate parasite control programmes remain the primary reason for persistent gastrointestinal parasitism in companion animals. Similar observations have been reported from several regions of India, where gastrointestinal helminths continue to represent one of the most frequently diagnosed parasitic diseases in dogs.

Gastrointestinal parasites produce extensive pathological changes within the digestive tract. Attachment of parasites to the intestinal mucosa results in epithelial erosion, haemorrhage, inflammation and villous atrophy, ultimately reducing nutrient absorption. Blood-feeding nematodes such as *Ancylostoma caninum* produce continuous intestinal blood loss leading to iron deficiency and anemia, whereas large numbers of *Toxocara canis* may cause intestinal obstruction, poor growth and nutritional deficiencies. Taylor *et al.* (2016) [3] and Bowman (2021) [19] reported that chronic parasitic infections interfere with digestion, absorption and protein metabolism, thereby producing significant systemic effects.

Haematological alterations are among the earliest laboratory abnormalities associated with canine gastrointestinal parasitism. Qadir *et al.* (2011) [30] observed significant reductions in haemoglobin (Hb), total erythrocyte count (TEC) and packed cell volume (PCV) together with marked eosinophilia in naturally infected dogs. Likewise, Kumar *et al.* (2014) [26] reported anemia, leukocytosis and eosinophilia associated with *Toxocara canis* infection. Similar findings were documented by Pradeep (2016) [29], Baba *et al.* (2017) [16], Shahat *et al.* (2022) [31], Payghan *et al.* (2023) [28] and Audu and Yusuf (2024) [15], indicating that haematological evaluation provides valuable information regarding disease severity and host immune response. According to Thrall *et al.* (2022) [2] and Stockham and Scott (2008) [4], eosinophilia represents a characteristic response to helminth infections, whereas anemia reflects chronic blood loss, reduced erythropoiesis and nutritional deficiencies.

Serum biochemical alterations are equally important in evaluating organ function during parasitic infections. Significant reductions in serum total protein and albumin together with increased liver enzyme activities have been reported in infected dogs by Kumar *et al.* (2014) [26], Campos *et al.* (2017) [20], Shahat *et al.* (2022) [31], Saichenko *et al.* (2022) [32] and Payghan *et al.* (2023) [28]. Hypoproteinaemia and hypoalbuminemia primarily result from intestinal protein loss, malabsorption and chronic enteropathy, whereas increased alanine aminotransferase (ALT), aspartate aminotransferase (AST) and alkaline phosphatase (ALP) activities indicate hepatic stress caused by parasite migration and inflammatory changes. Ettinger *et al.* (2017) [5] and Thrall *et al.* (2022) [2] emphasised that combined haematological and biochemical evaluation provides a more comprehensive assessment of disease severity than clinical examination alone.

Accurate diagnosis of gastrointestinal parasitism depends primarily on fecal examination, including qualitative identification of parasite eggs and quantitative estimation of egg per gram (EPG) of feces. Zajac and Conboy (2021) [1] highlighted that fecal egg counting remains one of the most reliable methods for evaluating parasite burden and monitoring therapeutic efficacy. Furthermore, routine haematological and biochemical investigations complement fecal examination by assessing systemic alterations associated with parasitic infections.

Treatment of canine gastrointestinal parasites relies mainly on broad-spectrum anthelmintics such as fenbendazole and praziquantel. Fenbendazole acts by inhibiting parasite microtubule formation and glucose uptake, resulting in depletion of glycogen reserves and parasite death, whereas praziquantel increases calcium permeability in cestodes, causing muscular paralysis and elimination of the parasites (Bowman, 2021) [19]. Although these drugs remain highly effective, Kaplan and Vidyashankar (2012) [11] and Kaplan (2020) [12] emphasized the importance of monitoring anthelmintic efficacy because the emergence of drug resistance has become an increasing concern in veterinary parasitology.

Despite numerous studies describing haematological or biochemical alterations associated with gastrointestinal parasites, comprehensive investigations evaluating clinical manifestations, haematological changes, serum biochemical alterations and therapeutic response simultaneously in naturally infected dogs remain limited. Therefore, the present study was undertaken to evaluate the haematological and biochemical alterations associated with naturally occurring canine gastrointestinal parasitic infections, correlate these findings with clinical manifestations and assess therapeutic efficacy following appropriate anthelmintic treatment.

2. Materials and Methods

2.1 Experimental Animals

During the study period, 604 client-owned dogs presented to the Veterinary Clinical Complex with gastrointestinal and related clinical complaints were screened for gastrointestinal parasitic infections by fecal examination. Among these, 314 dogs (51.99%) were confirmed positive and included in the present study. Dogs of different breeds, ages and both sexes were included irrespective of their vaccination status. Information regarding previous deworming history was recorded. Additionally, 12 apparently healthy, parasite-negative adult dogs served as healthy controls for haematological and biochemical comparisons.

2.2 Clinical Examination and Fecal Analysis

A detailed history, including age, breed, sex, feeding practices, housing, vaccination and deworming status, was obtained from each owner. All dogs underwent a comprehensive clinical examination, and findings such as appetite, vomiting, diarrhoea, weakness, body condition, abdominal distension and mucous membrane colour were recorded before treatment and during follow-up.

Fresh fecal samples were collected aseptically and examined by direct smear, sedimentation and flotation techniques for qualitative identification of gastrointestinal parasites. Parasite ova were identified based on their morphological characteristics as described by Zajac and Conboy (2021) [1] and Bowman (2021) [19]. The intensity of infection was determined using the Modified McMaster technique to

estimate egg per gram (EPG) counts before treatment (Day 0) and on Days 7 and 21 after treatment for assessment of therapeutic efficacy.

2.3 Haematological and Serum Biochemical Analysis

Approximately 5 mL of blood was collected aseptically from each dog, with EDTA-anticoagulated blood used for haematological evaluation and serum used for biochemical analysis. Haematological parameters were analyzed using an automated veterinary haematology analyser, while serum biochemical parameters were estimated using a semi-automatic biochemical analyzer with commercially available diagnostic kits. The obtained results were interpreted according to the standard reference values described by Thrall *et al.* (2022) [2], Stockham and Scott (2008) [4] and Ettinger *et al.* (2017) [5].

2.4 Therapeutic Management and Post-Treatment Evaluation

Dogs diagnosed with gastrointestinal nematode infections were treated with fenbendazole (50 mg/kg body weight orally for three consecutive days), whereas dogs with cestode infections received praziquantel (5 mg/kg body weight orally as a single dose). Dogs with mixed infections received combination therapy along with supportive treatment, including hematinics, hepatoprotective agents and fluid therapy whenever indicated.

Clinical examination, haematological evaluation, serum biochemical analysis and fecal egg count estimation were repeated on Days 7 and 21 following treatments. Therapeutic efficacy was assessed based on improvement in clinical signs, restoration of haematological and biochemical parameters and reduction in fecal egg counts.

2.5 Statistical Analysis

All data were presented as mean $\pm$ Standard error (SE). Comparisons among healthy, infected, and recovered dogs were carried out using the Z-test, whereas differences between pre-treatment and post-treatment values were analyzed using the paired Z-test. Statistical significance was established at $P \leq 0.05$.

3. Results

3.1 Clinical Findings

During the study period, 604 client-owned dogs presented to the Veterinary Clinical Complex with gastrointestinal and related clinical complaints were screened for gastrointestinal parasitic infections by fecal examination. Of these, 314 dogs (51.99%) were confirmed positive and included in the present study. Clinical examination of the infected dogs revealed a wide spectrum of gastrointestinal and systemic manifestations. The most frequently observed clinical sign was anorexia (78.02%; 245/314), followed by diarrhoea (68.47%; 215/314), weakness (65.60%; 206/314), vomiting (41.08%; 129/314), pale mucous membranes (27.38%; 86/314), poor hair coat (23.24%; 73/314), emaciation (19.74%; 62/314), abdominal distension (14.96%; 47/314), pyrexia (14.01%; 44/314), lethargy (12.10%; 38/314) and congested mucous membranes (8.59%; 27/314). The distribution of clinical signs is presented in Table 1, while representative clinical manifestations are shown in Plate 1A-H.

3.2 Haematological and Serum Biochemical Findings

The haematological and serum biochemical profiles of healthy and parasitised dogs are presented in Tables 2 and 3, respectively.

Dogs naturally infected with gastrointestinal parasites exhibited significant haematological and biochemical alterations compared with apparently healthy controls. Haematological evaluation revealed significant ($P \leq 0.05$) reductions in haemoglobin concentration, total erythrocyte count, packed cell volume and lymphocyte count, whereas total leukocyte count, neutrophil count and eosinophil count were significantly increased. However, monocyte and platelet counts did not differ significantly ($P > 0.05$) between healthy and infected dogs.

Similarly, serum biochemical analysis demonstrated significantly ($P \leq 0.05$) increased activities of alanine aminotransferase (ALT), aspartate aminotransferase (AST) and alkaline phosphatase (ALP) in infected dogs. In contrast, serum total protein, albumin and blood urea nitrogen concentrations were significantly reduced compared with healthy controls. No statistically significant differences ($P > 0.05$) were observed in serum creatinine and total bilirubin concentrations between the two groups.

3.3 Therapeutic Response

Dogs diagnosed with gastrointestinal nematode infections were treated with fenbendazole (50 mg/kg body weight), whereas cestode infections were treated with praziquantel (5 mg/kg body weight). Dogs with mixed infections received combination therapy along with supportive treatment, including hematinics and hepatoprotective agents.

Clinical improvement was evident by Day 7 of treatment, with gradual improvement in appetite, activity, fecal consistency and mucous membrane colour. Approximately half of the affected dogs showed marked clinical recovery by Day 7, while complete resolution of clinical signs was observed by Day 21 as depicted in Table 5.

Post-treatment evaluation demonstrated significant ($P \leq 0.05$) improvement in haematological and biochemical parameters. Haemoglobin concentration, total erythrocyte count, packed cell volume, lymphocyte count, total protein, albumin and blood urea nitrogen increased significantly following therapy, whereas total leukocyte count, neutrophil count, eosinophil count and liver enzyme activities (ALT, AST and ALP) decreased significantly towards normal values. Monocyte count, platelet count, serum creatinine and total bilirubin remained statistically unchanged throughout the treatment period.

3.4 Therapeutic Efficacy

Therapeutic efficacy, evaluated based on fecal egg count reduction, demonstrated a pronounced decline in eggs per gram (EPG) values by Day 7 across all categories of gastrointestinal parasitic infections. By Day 21 post-treatment, parasite eggs were no longer detected in fecal samples from treated dogs, indicating 100% fecal egg count reduction in most infection groups, except for dogs with mixed nematode-cestode infections, where a near-complete reduction of $99.04 \pm 0.01\%$ was recorded. These findings demonstrate the high therapeutic efficacy of the treatment regimen, as presented in Table 4.

4. Discussion

Gastrointestinal parasitic infections remain one of the most frequently encountered health problems in companion animals, causing considerable morbidity and economic losses worldwide. In the present investigation, 604 client-owned dogs presented to the Veterinary Clinical Complex were screened by fecal examination, of which 314 dogs (51.99%) were confirmed positive for gastrointestinal

parasites and included in the detailed clinical, haematological, biochemical and therapeutic evaluation. The positivity observed in the present study indicates that gastrointestinal parasitic infections continue to be common among dogs despite the availability of effective anthelmintics. Similar prevalence has been reported by Kumar *et al.* (2014) [26], Pradeep (2016) [29], Shahat *et al.* (2022) [31], Payghan *et al.* (2023) [28] and Audu and Yusuf (2024) [15], who attributed differences in prevalence among studies to variations in climatic conditions, management practices, environmental contamination, age of animals and deworming status. Bowman (2021) [19] and Taylor *et al.* (2016) [3] also emphasized that warm and humid environments favour the survival of infective stages, thereby facilitating continuous transmission.

Clinical examination revealed anorexia, diarrhoea, weakness, vomiting, pale mucous membranes, poor hair coat, emaciation, abdominal distension, pyrexia and lethargy as the predominant clinical manifestations. These findings are in agreement with the observations of Kirokva *et al.* (2005) [25], Qadir *et al.* (2011) [30], Kumar *et al.* (2014) [26], Baba *et al.* (2017) [16], Gayatri and Soya (2018) [24], Shahat *et al.* (2022) [31] and Payghan *et al.* (2023) [28]. The observed clinical signs are mainly attributed to intestinal irritation, mucosal inflammation, impaired digestion, malabsorption of nutrients and blood loss caused by parasitic infestation. Bowman (2021) [19] reported that blood-feeding helminths such as *Ancylostoma caninum* induce chronic intestinal haemorrhage leading to anemia and weakness, whereas heavy *Toxocara canis* infections interfere with nutrient absorption and normal intestinal function. Similarly, Taylor *et al.* (2016) [3] described chronic gastrointestinal parasitism as an important cause of weight loss, poor body condition and reduced performance in dogs.

The present investigation demonstrated significant haematological alterations in dogs affected with gastrointestinal parasites. Significant reduction in haemoglobin concentration, total erythrocyte count and packed cell volume indicated the presence of anemia. These findings corroborate those of Qadir *et al.* (2011) [30], Kumar *et al.* (2014) [26], Dracz *et al.* (2014) [23], Da Silva *et al.* (2015) [21], Pradeep (2016) [29], Baba *et al.* (2017) [16], Shahat *et al.* (2022) [31], Payghan *et al.* (2023) [28] and Audu and Yusuf (2024) [15]. According to Thrall *et al.* (2022) [2] and Stockham and Scott (2008) [4], anemia associated with gastrointestinal parasitism results primarily from chronic intestinal blood loss, reduced nutrient absorption, iron deficiency and impaired erythropoiesis. Blood-feeding nematodes such as *Ancylostoma* spp. contribute substantially to the development of regenerative anemia through continuous blood loss.

Leucocytosis characterized by neutrophilia and eosinophilia, together with lymphopenia, was also observed in the infected dogs. Similar haematological changes have been documented by Qadir *et al.* (2011) [30], Kumar *et al.* (2014) [26], Shahat *et al.* (2022) [31] and Payghan *et al.* (2023) [28]. Eosinophilia is considered a characteristic response during helminth infections and reflects activation of the host immune system against migrating larval stages. Tizard (2022) [6] and Thrall *et al.* (2022) [2] reported that eosinophils play an important role in host defence against parasitic infections through antibody-mediated cytotoxic mechanisms. The absence of significant alterations in monocyte and platelet counts observed in the present study

suggests that these parameters are less consistently affected during uncomplicated gastrointestinal parasitic infections.

Serum biochemical evaluation revealed significantly increased ALT, AST and ALP activities together with decreased total protein, albumin and blood urea nitrogen concentrations in infected dogs. Comparable findings have been reported by Kumar *et al.* (2014) [26], Campos *et al.* (2017) [20], Mazaro *et al.* (2019) [27], Shahat *et al.* (2022) [31], Saichenko *et al.* (2022) [32] and Payghan *et al.* (2023) [28]. Elevated liver enzyme activities may be attributed to hepatocellular injury, inflammatory changes or metabolic stress associated with parasitic migration and chronic infection. Reduced serum protein and albumin concentrations are likely the consequence of intestinal protein loss, impaired nutrient absorption and chronic enteropathy. Ettinger *et al.* (2017) [5] and Thrall *et al.* (2022) [2] also stated that chronic gastrointestinal disease commonly results in hypoproteinaemia owing to protein-losing enteropathy and malnutrition. The absence of significant changes in serum creatinine and total bilirubin indicates that renal function and bilirubin metabolism remained largely unaffected in the majority of infected dogs.

Administration of fenbendazole for nematode infections and praziquantel for cestode infections and a combination of both drugs for mixed infection produced marked clinical improvement in the affected dogs. Clinical recovery became evident by Day 7 and was complete by Day 21 following treatment. Haematological and biochemical abnormalities showed significant improvement after therapy, indicating restoration of normal physiological function following elimination of the parasites. Similar therapeutic responses have been documented by Bowman (2021) [19], Payghan *et al.* (2023) [28] and Baba *et al.* (2017) [16]. The progressive normalisation of erythrocytic indices, leukocyte profile and serum biochemical parameters observed in the present study confirms the effectiveness of appropriate anthelmintic therapy when combined with supportive management.

The treatment regimen resulted in a substantial reduction in fecal egg counts, culminating in complete disappearance of parasite eggs by Day 21 in the gastrointestinal nematode, cestode, and mixed nematode infection groups. A near-complete therapeutic response was also observed in dogs with mixed nematode-cestode infections, with efficacy reaching 99.04±0.01% on Day 21. Overall, these findings confirm the high therapeutic efficacy of the treatment regimen. These observations are consistent with the findings of Doenhoff *et al.* (2008) [22], Bowman (2021) [19], Zajac and Conboy (2021) [1] and Payghan *et al.* (2023) [28], who reported high efficacy of fenbendazole and praziquantel against susceptible gastrointestinal nematodes and cestodes. However, Kaplan and Vidyashankar (2012) [11] and Kaplan (2020) [12] emphasised the need for regular monitoring of anthelmintic efficacy because resistance to commonly used drugs is an emerging concern in veterinary parasitology.

Overall, the findings of the present study demonstrate that naturally occurring gastrointestinal parasitic infections produce significant clinical illness accompanied by characteristic haematological and biochemical alterations. Routine fecal examination, supported by haematological and biochemical investigations, provides valuable information for diagnosis, assessment of disease severity, therapeutic monitoring and prognosis. Regular deworming programmes, improved hygiene and periodic screening remain essential for effective control of canine gastrointestinal parasites and for minimising their impact on animal health and public health.

Table 1: Clinical signs in dogs affected with GI parasitic infestation

Sl. No.	Clinical Signs	Infested dogs (n=314)	Per cent (%)
1.	Anorexia	245	78.02
2.	Diarrhoea	215	68.47
3.	Weakness	206	65.60
4.	Vomiting	189	60.19
5.	Pale mucous membrane	186	59.23
6.	Poor coat	73	23.24
7.	Emaciated	62	19.74
8.	Abdominal distension	47	14.96
9.	Pyrexia	44	14.01
10.	Lethargy	38	12.10
11.	Congested mucus membrane	27	8.59

Table 2: Mean $\pm$ SE of Haematological changes in GI parasitic infestation dogs (n=314) before and after treatment

Sl. No.	Parameter	Apparently healthy adult dogs (n=12)	GI parasitic infested dogs (n=314)	
			Day 0	Day 21
1	Hb (g/dl)	13.38 $\pm$ 0.23 ^a	8.19 $\pm$ 0.11 ^c	10.49 $\pm$ 0.103 ^b
2	TEC (10 ³ /mm ³)	6.62 $\pm$ 0.10 ^a	3.54 $\pm$ 0.05 ^c	4.78 $\pm$ 0.051 ^b
3	TLC (10 ³ /mm ³)	9.15 $\pm$ 0.28 ^c	17.67 $\pm$ 0.47 ^a	12.17 $\pm$ 0.22 ^b
4	N (%)	67.67 $\pm$ 0.31 ^b	72.49 $\pm$ 0.25 ^a	67.6 $\pm$ 0.12 ^b
5	L (%)	27.92 $\pm$ 0.29 ^a	18.1 $\pm$ 0.23 ^c	27.9 $\pm$ 0.11 ^a
6	E (%)	2.3 $\pm$ 0.18 ^b	7.69 $\pm$ 0.11 ^a	2.76 $\pm$ 0.04 ^b
7	M (%)	2.08 $\pm$ 0.22 ^a	1.71 $\pm$ 0.05 ^a	1.73 $\pm$ 0.05 ^a
8	Platelets(10 ⁵ /mm ³)	3.45 $\pm$ 0.77 ^a	3.45 $\pm$ 0.05 ^a	3.46 $\pm$ 0.051 ^a
9	PCV (%)	39.65 $\pm$ 0.54 ^a	24.78 $\pm$ 0.33 ^c	31.46 $\pm$ 0.30 ^b

Note: Means bearing different superscripts are significantly different at $p < 0.05$ **Table 3:** Mean $\pm$ SE of serum biochemical changes in GI parasitic infestation dogs (n=314) before and after therapy

No	Parameter	Apparently health dogs(n=12)	GI parasitic infested dogs (n=314)	
			Day 0	Day 21
1	SGPT	58.08 $\pm$ 3.28 ^c	124.78 $\pm$ 2.27 ^a	90.01 $\pm$ 1.58 ^b
2	SGOT	50.67 $\pm$ 3.04 ^c	119.182.25 ^a	84.74 $\pm$ 1.66 ^b
3	ALP	82.41 $\pm$ 6.04 ^c	156.7 $\pm$ 62.59 ^a	118.26 $\pm$ 1.97 ^b
4	TP	6.4 $\pm$ 0.15 ^a	4.31 $\pm$ 0.05 ^c	5.71 $\pm$ 0.04 ^b
5	Albumin	3.08 $\pm$ 0.08 ^a	1.84 $\pm$ 0.03 ^c	2.69 $\pm$ 0.02 ^b
6	Creatinine	1.03 $\pm$ 0.08 ^a	1.03 $\pm$ 0.02 ^a	1.03 $\pm$ 0.018 ^a
7	Bilirubin	0.20 $\pm$.003 ^a	0.20 $\pm$ 0.006 ^a	0.20 $\pm$ 0.004 ^a
8	BUN	19.67 $\pm$ 1.11 ^a	17.17 $\pm$ 0.51 ^c	18.85 $\pm$ 0.39 ^b

Note: Means bearing different superscripts are significantly different at $p < 0.05$ **Table 4:** Therapeutic efficacy of fenbendazole and praziquantel on GI parasites

Sl. No.	Gastrointestinal Parasite	%Therapeutic efficacy (Day 0)	%Therapeutic efficacy (Day 7)	%Therapeutic efficacy (Day 21)
1	GI Nematodes (205)	1089.21 $\pm$ 36.79 ^a	95.40 $\pm$ 0.70 ^b	100 $\pm$ 0 ^c
2	Cestodes (88)	1108 $\pm$ 56.85 ^a	95.80 $\pm$ 0.85 ^b	100 $\pm$ 0 ^c
3	Mixed infection (7) (Nematodes+Cestodes)	1385 $\pm$ 172.18 ^a	89.5 $\pm$ 3.366 ^b	99.04 $\pm$ 0.01 ^c
4	Mixed infection (14) (Nematodes+ Nematodes)	1760 $\pm$ 156.84 ^a	90.91 $\pm$ 3.26 ^b	100 $\pm$ 0 ^c

Note: Means bearing different superscripts are significantly different at $p < 0.05$ **Table 5:** Post therapeutic clinical improvement in dogs affected with Canine GIP (n=314)

Parameter		Day 0	Day 7	Day 21
General activity	Weakness	206	78	05
	Lethargy	38	21	02
Temperature	Pyrexia	44	12	00
	Normal	270	302	314
Appetite	Anorexia	245	85	09
	Normal appetite	119	251	303
Conjunctival/buccal mucous membrane	Pale	186	93	00
	Congested	27	9	00
	Normal	101	212	314
Diarrhoea	Foul smell yellowish diarrhoea	127	38	00

	Bloody diarrhoea	48	11	00
	Sticky Mucus diarrhoea	40	03	00
	Normal	99	262	314
Change in faeces colour	Black	37	06	00
	Brown	63	14	00
	Brown-Yellowish	21	08	00
	Yellowish	193	286	314
Vomiting	Present	189	67	00
	Absent	125	247	314



Plate 1 A Pale Conjunctival mucous membrane due to intravascular and extravascular haemolysis



Plate 1B Pot belly appearance due to *T. canis*



Plate 1C Distended Abdomen

Plate 1: Clinical signs in GI parasitic infested dogs



Plate 1D Pyrexia due to Parasitic destruction



Plate 1E Weakness



Plate 1F Lethargy



Plate 1G Poor hair coat



Plate 1H Congested Conjunctival mucous membrane due to haemoconcentration



Plate 1I Emaciated

Plate 1: Clinical signs in GI parasitic infested dogs

5. Conclusion

The present study demonstrated that gastrointestinal parasitic infections remain an important health concern in dogs. Among the 604 dogs screened by fecal examination, 314 dogs (51.99%) were diagnosed with gastrointestinal parasitic infections and were subsequently evaluated for clinical, haematological, biochemical and therapeutic parameters. The infected dogs exhibited characteristic clinical signs, including anorexia, diarrhoea, weakness, vomiting and pale mucous membranes, indicating the

adverse effects of parasitism on general health and nutritional status.

Significant haematological alterations, characterized by anemia, leucocytosis, neutrophilia, eosinophilia and lymphopenia, together with biochemical abnormalities including elevated ALT, AST and ALP activities and reduced serum total protein, albumin and blood urea nitrogen concentrations, confirmed that gastrointestinal parasitic infections produce systemic effects extending beyond the gastrointestinal tract. These laboratory findings

proved valuable in assessing disease severity and monitoring the response to therapy.

Treatment with fenbendazole (50 mg/kg body weight) for nematode infections and praziquantel (5 mg/kg body weight) for cestode infections, together with appropriate supportive therapy, resulted in rapid clinical recovery, significant improvement in haematological and biochemical parameters and complete (100%) fecal egg count reduction by Day 21, while dogs with mixed nematode-cestode infections exhibited 99.04±0.01% efficacy, demonstrating excellent therapeutic efficacy.

The findings of the present study emphasize that routine fecal examination, combined with haematological and serum biochemical evaluation, constitutes a reliable approach for the diagnosis, assessment and therapeutic monitoring of canine gastrointestinal parasitic infections. Regular deworming programmes, improved hygiene, periodic fecal screening and owner awareness are essential for reducing the burden of gastrointestinal parasites and minimising their impact on canine health and their zoonotic risk to humans.

Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this manuscript.

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