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Gastrointestinal Manifestations in Dogs: Epidemiology and Presence of Systemic Diseases

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Abstract: Chronic gastrointestinal disorders are difficult to manage because of the vagueness in clinical signs, history and limitations of the diagnostic procedures and the multiplicity of possible causes. They are also among the most common presentations in general practice. This study explored the epidemiology of gastrointestinal manifestations in dogs and ascertained by a separate prospective study if these gastrointestinal manifestations were due to primary gastrointestinal disease processes. Medical records of dogs presented to the Bangalore Veterinary College (January to December 2008) were analyzed retrospectively. A prospective study included 81 dogs who were presented with gastrointestinal manifestations and were worked up to arrive at a diagnosis which was further classified as a primary gastrointestinal disease or a systemic disease. The overall prevalence of gastrointestinal manifestations was 20.45%. Among the 1746 dogs presented with gastrointestinal manifestations, mongrels (26.35%), age groups between 1-4 years (23.60%) and males (55.04%) predominated. Most common manifestations were vomiting (55.7%), diarrhoea (29.2%) and anorexia (26.9%). Of these 81 dogs, 54.32% had systemic diseases not related to the gastrointestinal tract based on laboratory investigations (hematology, biochemistry, urinanalysis and fecal assessment), physical examination and other diagnostics procedures. Gastrointestinal signs warrant a thorough diagnostic research up in canines.

Key words: Canine, gastrointestinal manifestations, epidemiology, physical examination, mongrels

INTRODUCTION

There has been a paradigm shift in the veterinary profession which is confronted today with disease entities of multifactorial origins and possibly complex etiologies. These challenges demand prompt recognition of the problem and analyzing data to quantify and intensively examine multiple disease determinants which may directly or indirectly affect the pathogenesis or outcome of a disease.

The gastrointestinal system is never considered critical to life nor significant in the maintenance of overall homeostasis, however among veterinary medical issues in small animal practice, gastrointestinal issues are a top five complaint among pet owners. They are a top reason for presentation of dogs and cats to veterinarians, accounting for 20-25% of veterinary visits (Bradley and King, 2012). A recent study in the United States from over 2 million dogs in 2012 report gastrointestinal upset/gastroententeritis and colitis among the top 20 reasons for presentation to a veterinary practice with about 2-4% of the of the proportion of the animals in all the different age groups being affected. Gastrointestinal manifestations include clinical signs arising from disease processes that would primarily involve organs in the gastrointestinal tract. Clinical signs observed in alimentary tract disorders are nonspecific (Sunitha Rao, 2012). This arises from vagueness of the history, non-specific symptoms, wide and sometimes confusing range of complementary tests (Stephens, 2001). The prevalence of different gastrointestinal manifestations in dogs have not been studied in the same intensity as other canine diseases. Gastrointestinal (GI) manifestations are not restricted to diseases of the gastrointestinal tract and may have a non-GI focus. It is here that epidemiological studies are advocated to evolve a better understanding of true gastrointestinal diseases. In the present study, an emphasis has been made to ascertain the prevalence of

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gastrointestinal manifestations in the Indian scenario as there is a paucity of such information from developing countries. The second emphasis of this study was to differentiate GI manifestations due to GI or non-GI loci and evaluate their prevalence as this would be of paramount importance for the field canine practitioner an earlier studies from the United Kingdom (Simpson, 2005) have shown that only about 10% of dogs with diarrhea and 5% of dogs that vomited are presented to veterinarians and with the decreasing trends (Biourge, 2006) in veterinary visits due to economic and other reasons, these numbers may become even lower. The global trends in dogs population vary from country to country, however, India is expected to have the fastest growing dog population, since 2007 (~58%) and a population of about 10.2 million in 2012 which makes studies like this significant. Bangalore city had an estimated dog population of 3,27,218 in 2007 making the results from this study significant on a global level.

MATERIALS AND METHODS

Epidemiological data regarding the occurrence of gastrointestinal manifestations/disorders in dogs was screened from the records of Veterinary College Hospital for a period of 1 year from January to December 2008. Those cases exhibiting gastrointestinal manifestations were considered for the epidemiological study and they were analyzed with respect to age, gender, breed and clinical manifestations.

Dogs presented to the Veterinary College Hospital, Hebbal and those referred from other veterinary practices (Government and Private) in and around Bangalore and other parts of Karnataka, India with a history of gastrointestinal manifestations were considered for the prospective study. The study spanned from September 2008 to February 2009. It was not necessary to require a formal approval for the study, since all the dogs were sampled under informed consent of the owner, during diagnostic procedures also the University Research Committee (with the IUCAC) had reviewed the research proposal and it was approved.

All glasswares were of Borosil/Corning make and were procured from M/s. Mayora Scientific, Bangalore. Chemical reagents were procured from M/s Nice Chemicals, Cochin. Detailed gastrointestinal history followed by general physical examination was performed as described by Hubbard *et al.* (2007), body score conditioning and detailed investigation of gastrointestinal and integumentary system was employed. Blood, urine and fecal samples were collected as per standard diagnostic protocols. The hematological parameters estimation was carried out with whole blood in EDTA. The parameters were assayed on the day of collection. Serum was used to determine bilirubin, aspartate aminotransferase, alanine aminotransferase, alkaline phosphatase, blood urea nitrogen, creatinine, protein, albumin, globulin, glucose, sodium, potassium, chloride and calcium by Artos biochemical analyzer using commercial reagent kits supplied by M/s Swemed Diagnostics, Bangalore. The parameters were estimated on the day of collection when possible. Urine examination was done as per the procedure described by Volk *et al.* (2011), fecal scoring where possible was done by visual examination or owner questioning from grades of 1-5 as per the visual grades described Royal Canin®. The gross examination of faeces and microscopic examination for the presence of amylorrhoea, creatorrhoea and steatorrhoea were performed as per the procedure described by Volk *et al.* (2011). Fecal cytology (wet and dry mounts) was processed as described by Tams (2007). Sedimentation/floatation techniques for parasitic ova and oocyst were done as per the procedure described by Benjamin (1985) using zinc sulphate solution with a specific gravity of 1.20.

Standard gastrointestinal research sheet was evolved for history collection. The physical examination and laboratory findings were also recorded in the research sheet. A detailed gastrointestinal history followed by physical examination were followed by collection of clinical samples (whole blood, serum, urine and fecal sample) and other routine clinical measures like radiography, ultrasonography, endoscopy, exploratory surgery, cytology or even biopsy were used to ascertain a final diagnosis and then these were classified into GI and non-GI disease loci. Where appropriate final diagnosis was not possible due to lack of appropriate gold standard testing, a final diagnosis was reached based on exclusion and/or response to therapy (e.g., exocrine pancreatic insufficiency). The final diagnosis were overseen by faculty who are trained specialists (MVSc. and Ph.D. in Veterinary Medicine) at the University Teaching hospital and have been teaching veterinary medicine for atleast 5 years and are at a level of a tenured Assistant professor.

Statistics: The data obtained were subjected for statistical analysis using Graph Pad Prism Software (GraphPad Software, Inc. La Jolla, CA 92037 USA). Statistical significance was set at $p<0.05$.

RESULTS AND DISCUSSION

Epidemiology: It was observed that over a period of 1 year (January to December 2008), 8536 dogs were presented to

the Veterinary College Hospital, out of these 1746 (20.45%) cases were presented with gastrointestinal manifestations (Table 1).

Among the 1746 dogs presented with gastrointestinal manifestations the various breeds included mongrel (26.35%), spitz (17.53%), labrador retriever (14.49%), GSD (10.88%), great dane (5.67%), dalmatian (5.44%), pug (4.93%), dachshund (3.61%), rottweiler (2.69%), neopolitian mastiff (2.35%), boxer (2.23%), golden retriever (1.78%) and others (2.06%). There was significant ($p<0.05$) difference between the breeds presented with gastrointestinal manifestations.

Age-wise distribution of dogs with gastrointestinal manifestations included 0-3 months December 25, 2013 (21.99%), >3-6 months (13.63%), >6 months to 1 year (15.41%), >1-4 years (23.60%), >4-8 years (15.41%), >8-12 years (6.36%) and >12+ years (3.61%). There was significant (p:S 0.05) age-wise difference between age groups presented with gastrointestinal manifestations.

Males constituted 55.04% and females 44.96% of animals presented with gastrointestinal manifestations. There was no significant difference between the gender of animals presented with gastrointestinal manifestations ($p>0.05$).

The various gastrointestinal manifestations included vomiting (55.7%), diarrhoea (29.2%), anorexia (26.9%), melena (7.5%), salivation (6.4%), ascites (5.7%), icterus (1.9%), epigastricpain (1.0%), no motions (0.7%), anemia (0.6%), weight loss (0.5%), palpable abdominal mass (0.3%), bulky stools (0.3), abdominal distension and tympany (0.2%), rectal prolapse (0.1%) and polyuria/polydipsia (0.1%).

Table 1: Distribution of dogs in the retrospective study (January to December 2008) at the Veterinary College Hospital based on gastrointestinal and non-gastrointestinal manifestations (n = 8536)

Clinical signs	Number of dogs presented	Percentage
Gastrointestinal manifestations	1746	20.45
Other manifestations	6790	79.55
Total	8536	100.00

Prospective study: A total of 81 dogs exhibiting clinical signs of gastrointestinal disorders were prospectively included in the study. Among the disease in these 81 dogs, systemic diseases constituted 54.32% and gastrointestinal diseases constituted 45.68%. Diseases diagnosed among the 81 dogs with gastrointestinal manifestations included 23.46% renal insufficiency, 14.81% leptospirosis, 9.88% non-specific gastroenteritis, 9.88% helminthosis, 7.41% ehrlichiosis, 7.41% hepatic insufficiency, 6.17% parvoviral gastroenteritis, 3.70% intestinal foreign body, 3.70% pyometra, 2.47% inflammatory bowel disease, 1.23% acute myeloid leukemia, 1.23% dietary insensitivity, 1.23% exocrine pancreatic insufficiency, 1.23% fibro-epithelial dental polyp, 1.23% paralytic ileus, 1.23% peritonitis, 1.23% paraneoplastic syndrome, 1.23% Small Intestinal Bacterial Overgrowth (SIBO)/Antibiotic Responsive Diarrhoea (ARD) and 1.23% vestibular disease. The clinical signs, complete blood count and biochemical parameters are attached in Table 2-4.

The overall gastrointestinal manifestations in canine cases presented to the veterinary teaching hospital in 2008 were 20.45% which contributed to about one fifth of all clinical manifestations presented. This indicates that gastrointestinal manifestations are a common problem in this geographical area and relate to earlier studies which have described a prevalenceof 20-25%. However, prevalence of gastrointestinal manifestations under Indian

Table 2: Clinical manifestations in dogs with gastrointestinal disorders (n = 81)

Number of dogs	Percentage of dogs (%)	Clinical manifestations	Diagnosis
19	23.46	Anorexia, chronic vomiting, melena, diarrhoea, polyuria and polydipsia	Renal insufficiency
12	14.81	Anorexia, vomiting, hematemesis and diarrhoea	Leptospirosis
8	9.88	Anorexia, vomiting and diarrhoea	Non specific gastroenteritis
8	9.88	Vomiting, chronic vomiting, anorexia, diarrhoea and hematochezia	Helminthosis
6	7.41	Anorexia, vomiting, hematemesis and melena	Ehrlichiosis
6	7.41	Anorexia, vomiting, hematemesis and melena	Hepatic insufficiency
5	6.17	Vomiting, anorexia, hematochezia and diarrhoea	Parvoviral gastroenteritis
3	3.70	Vomiting and not passing motion	Intestinal foreign body
3	3.70	Anorexia, vomiting and distension of abdomen	Pyometra
2	2.47	Vomiting and diarrhoea	Inflammatory bowel disease
1	1.23	Excessive salivation and anorexia	Acute myeloid leukemia
1	1.23	Vomiting and diarrhoea	Dietary insensitivity
1	1.23	Vomiting and bulky stools	Exocrine pancreatic insufficiency
1	1.23	Salivation and halitosis	Fibroepitheilal dental polyp
1	1.23	Vomiting and not passing stools	Paralytic ileus
1	1.23	Anorexia and vomiting	Peritonitis
1	1.23	Chronic vomiting and and weight loss	Paraneoplastic syndrome
1	1.23	Chronic vomiting and diarrhoea	Small Intestinal Bacterial Overgrowth (SIBO)/ Antibiotic Responsive Diarrhoea (ARD)
1	1.23	Anorexia and vomiting	Vestibular disease

Table 3: Hematological findings in dogs with gastrointestinal manifestations (n = 81)

		Differential leucocytic count									
Dignosis	Total leucocytic count (cell/μL)	Neutrophils (%)	Band cells (%)	Lympocytes (%)	Monocytes (%)	Eosinophils (%)	Basophils (%)	Total erythrocytes count (×10^4 cells/μL)	Hemoglobin (g/dL)	PVC (%)	Plateletes (×10^3/μL)
Renal insufficiency	13522.11±1412	79.05±1.96	0.26±0.18	19.32±2.16	0.37±0.17	0.42±0.18	-	5.73±0.31	11.62±0.63	35.4±1.79	3.23±0.39
Leptospirosis	40800±2946	91.5±0.88	1.17±0.30	4.83±1.30	0.42±0.29	0.17±0.11	-	5.58±0.53	11.35±1.05	34.93±3.12	2.36±0.22
Non specific gastroenteritis	13618.75±1245	78±1.69	-	19.13±1.50	1.13±0.34	0.88±0.75	-	6.63±0.45	13.49±0.84	40.98±2.12	3.15±0.42
Helminthosis	17206.25±2481	77.75±3.73	-	20.88±3.67	2.5±1.5	4±0	-	5.89±0.56	13.11±0.71	44.25±2.62	2.85±0.21
Ehrlichiosis	8416.67±1212	78.5±1.93	3	18.17±1.42	3.25±1.65	2.5±0.65	-	4.48±0.49	9.28±1.03	31.00±2.94	0.72±0.20
Hepatic insufficiency	37146.67±12261	88.83±2.20	0.17±0.17	10±2.07	0.67±0.33	0.33±0.21	-	6.44±0.44	14±0.92	44.18±3.30	2.63±0.33
Parvoviral gastroenteritis	5080±864.5	82.6±2.77	-	15.8±2.13	-	-	-	5.77±0.44	12.92±1.61	43.4±5.21	2.51±0.24
Intestinal foreign body	33533.33±10431	88.33±2.19	-	7.6±3.18	4±3	2	-	7.07±0.59	12.2±1.64	35.33±7.42	2.65±0.24
Pyometra	31450±8947	92.67±1.45	-	5±1.16	1	-	-	4.52±1.18	9.87±2.66	30.6±8.40	2.11±0.42
Inflammatory bowel disease	49650±4850	92.5±2.5	-	6±2	1±1	0.5±0.5	-	5.29±1.1	11.1±1.7	33.75±6.25	4.135±1.45
Acute myeloid leukemia	128000	95	-	5	-	-	-	6.50	13.00	39.00	2.00
Dietary Insensitivity	22800	63	-	32	4	1	-	6.00	12.00	37.00	2.50
Exocrine pancreatic insufficiency	13600	91	-	8	-	1	-	7.10	13.20	37.00	4.50
Fibroepitheilal dental polyp	18000	87	-	13	-	-	-	8.50	17.00	49.00	3.20
Paralytic ileus	38500	90	5	5	-	-	-	4.50	9.00	27.00	2.00
Peritonitis	8200	87	-	13	-	-	-	7.10	14.20	41.00	3.00
Paraneoplastic syndrome	7400	87	-	13	-	-	-	6.80	15.00	40.00	2.30
SIBO/ARD	20000	82	-	16	-	1	-	8.20	16.00	52.00	2.93
Vestibular disease	11200	87	-	13	-	-	-	8.00	16.00	45.00	3.00

Table 4: Biochemical findings in dogs with gastrointestinal manifestations (n = 81)

Diagnosis	Total protein (g/dL)	Albumin (g/dL)	Globulin (g/dL)	Glucose (mg/dL)	Sodium (mEq/L)	Potassium (mEq/L)	Chloride (mEq/L)
Renal insufficiency	5.34±0.24	2.75±0.24	2.67±0.20	93±4.13	141.37±1.56	4.84±0.16	108.21±2.25
Leptospirosis	5.56±0.27	2.88±0.17	2.68±0.21	123.67±13.54	142.92±1.99	4.68±0.17	107.58±2.60
Non specific gastroenteritis	6.43±0.30	3.59±0.30	2.84±0.18	95±4.18	137.13±1.26	3.83±0.20	100.5±2.20
Helminthosis	5.06±0.17	2.63±0.26	2.44±0.27	91.35±6.59	143±1.82	3.99±0.23	99.28±4.13
Ehrlichiosis	5.37±0.25	2.15±0.11	3.22±0.24	104.33±2.51	143.67±1.69	4.23±0.18	107±3.39
Hepatic insufficiency	5.63±0.45	2.83±0.41	2.80±0.47	88.80±7.34	141.67±2.25	4.75±0.22	103.83±3.14
Parvoviral gastroenteritis	4.56±0.26	2.2±0.22	2.36±0.11	79.4±6.86	134±3.41	3.42±0.13	97.6±2.46
Intestinal foreign body	5.5±0.29	2.73±0.22	2.43±0.28	87.84±5.92	140.33±1.45	3.96±0.18	102±3.06
Pyometra	4.8±0.40	3.37±0.32	1.43±0.44	96.33±14.31	144.33±3.18	5.03±0.12	106±3.06
Inflammatory bowel disease	5.15±0.45	2.1±0.1	3.05±0.35	119±21	139±8	3.2±0.6	100.5±2.5
Acute myeloid leukemia	7.00	2.50	4.50	112.00	147.00	4.50	112.00
Dietary insensitivity	5.40	2.70	2.70	116.00	154.00	4.00	110.00
Exocrine pancreatic insufficiency	6.10	3.70	2.40	86.00	147.00	4.29	108.00
Fibroepitheilal dental polyp	6.50	3.00	3.50	111.00	145.00	4.50	102.00
Paralytic ileus	4.00	2.00	2.00	78.00	138.00	3.40	98.00
Peritonitis	6.10	4.00	1.90	98.00	118.00	5.30	83.00
Paraneoplastic syndrome	5.50	2.30	3.20	117.00	140.00	4.50	107.00
SIBO/ARD	6.00	2.40	3.60	119.13	142.00	3.90	114.00
Vestibular disease	6.70	2.20	4.50	157.00	147.00	4.50	118.00
Renal insufficiency	11.96±0.43	0.73±0.05	45.29±9.01	42.89±2.53	52.79±9.80	240.79±29.47	11.66±1.72
Leptospirosis	9.358±0.28	2.87±1.85	60.99±17.06	48.88±10.87	227.42±111	81.0±29.49	2.85±0.85
Non specific gastroenteritis	9.93±0.22	0.38±0.05	32.15±3.27	33.63±3.46	86.5±32.91	20±2.49	0.86±0.15
Helminthosis	9.65±0.47	0.57±0.08	38.5±5.8	39.88±3.06	76.5±24.19	21.64±2.06	0.975±0.08
Ehrlichiosis	9.3±0.43	0.73±0.08	48.03±6.44	40.83±5.90	96.66±43.07	17.55±2.13	0.87±0.15
Hepatic insufficiency	8.47±0.30	1.37±0.40	196.25±35.12	170.33±49.5	719.83±185	25±1.92	1.24±0.22
Parvoviral gastroenteritis	8.34±0.27	0.63±0.09	31.82±7.29	32.8±7.34	37.2±7.39	20±2.15	0.52±0.09
Intestinal foreign body	9.37±0.42	0.6±0.15	43.33±4.26	31±6.03	207.66±46.07	25.67±4.26	0.87±0.22
Pyometra	10.27±0.43	0.53±0.12	35.92±8.73	59±7.02	129.33±47.51	169.97±63.04	7.64±1.58
Inflammatory bowel disease	9.75±0.45	1.93	29.65±7.35	93.5±44.5	171.15±125.2	17.85±0.15	0.98
Acute myeloid leukemia	10.20	0.30	34.00	35.00	104.00	23.00	1.20
Dietary insensitivity	9.00	0.50	18.00	46.00	249.00	10.20	0.90
Exocrine pancreatic insufficiency	10.21	0.50	125.00	45.00	451.00	24.00	0.50
Fibroepitheilal dental polyp	9.00	0.90	45.00	65.00	135.00	40.00	1.40
Paralytic ileus	8.00	0.90	123.45	45.00	139.00	43.00	0.25
Peritonitis	9.00	0.60	36.00	45.00	501.00	39.00	2.30
Paraneoplastic syndrome	14.00	0.50	46.00	45.00	200.00	26.00	0.80
SIBO/ARD	8.95	0.50	35.00	32.00	304.70	25.00	1.08
Vestibular disease	10.10	0.40	26.00	32.00	129.00	27.00	0.37

conditions lack proper documentation except for isolated reports by Broussard (2003) and Saravanan *et al*. (2009) who reported a prevalence of 16.23%. This is approximately half (~10%) if all age groups are combined in the report from the United States and can be attributable to cultural and management variations in management of canine husbandry and veterinary medicine practices. Infectious diseases are thought to be less prevalent in the countries like the United States where a larger percentage of the pet population is vaccinated.

The occurrence of gastrointestinal manifestations among the different breeds presented revealed a significant variation. ($p<0.05$), in that it was highest among Mongrels with 26.35%. An earlier study

(Dryden *et al*., 2005) from the same geographical area has reported highest prevalence of gastroenteritis in Non-descripts followed by Spitz and GSD. This indicates a possible overrepresentation of these breeds in the local population. No control population data was available from local governmental authorities and hence normalization to evaluate the over or underrepresentation of breeds were not possible. A recent Norwegian longitudinal study in 4 dog breeds has reported a significant breed variation in the observance of vomiting and diarrhea, however other studies from the UK have failed to show any variation in the frequency of vomiting or diarrhea among different breeds.

The occurrence of gastrointestinal manifestations among the different age groups presented revealed a significant variation ($p<0.05$), in that it was highest among dogs >1-4 years followed by puppies in range of 0-3 months. Earlier studies reported the highest prevalence of gastroenteritis from 18.35% (Benjamin, 1985) to 59.5% (Saravanan *et al*., 2009) in puppies below 6 and 4 months, respectively. This disagreement may be attributed again to considering only gastroenteritis as the criteria for selecting cases for the study or it may be a reflection of the distribution of various age groups in the population. Recent reports from Norway show that diarrhea and vomiting are more common in puppies and colitis and gastrointestinal upsets were also reported to be more common in juveniles (0-1 years) in the United States.

Saravanan *et al.* (2009) and Alamelu (2000) also reported no significant difference in the sex-wise distribution of dogs with viral gastroenteritis. The report of the present study confirms the findings of earlier workers. No sex predisposition was observed in.

In the 1746 gastrointestinal cases encountered, the most common clinical manifestation observed was vomiting (55.7%). Nakade *et al*. (2009) and Udupa (1991) consider vomiting as a common presenting complaint in canine clinical practice. However, the high prevalence of vomiting may be attributedto primary gastrointestinal disease and large number of extra GI-conditions (Nakade *et al*., 2009; Elwood, 2003). Vomiting and diarrhea have been reported as the most common clinical signs (Willard, 2008; Twedt, 2007). The other gastrointestinal manifestations like anorexia, melena, salivation, ascites, icterus, epigastric pain, no motions, anemia, weight loss, palpable abdominal mass, bulky stools, abdominal distension and tympany, rectal prolapse and polyuria/polydipsia reported in this study are in accordance with those reported by earlier researchers (Stephens, 2001; Kirby, 2007; Anderson, 1999).

A wide spectrum of non-specific clinical signs like vomiting, diarrhea to seizures has been documented in gastrointestinal diseases. Gastrointestinal manifestations are not restricted to diseases of the gastrointestinal tract and may have anon-GI focus. In this study, among the 81 dogs, with gastrointestinal manifestations, 54.32% had systemic affections and the other 45.68% had gastrointestinal disease. These findings corroborate with those of earlier researchers (Dryden *et al*., 2005; Nakade *et al*., 2009) who opined that gastrointestinal manifestation are seen in a large number of extra or non-gastrointestinal condition. Of these 81 dogs, the disease with the highest incidence was seen with renal insufficiency at 23.46%. This is in agreement by Casal (2008) who reported that 60% of dogs with renal failure had gastrointestinal signs.

The limitations of this study include the lack of confirmatory tests for certain diseases like exocrine pancreatic insufficiency like the cTLI, however, these were not crucial in establishing the second objective of the study, i.e., to differentiate between disease with or without a GI locus. Though the Bangalore Veterinary College is a primary care center, it is also a tertiary referral center for advanced diagnostics in the state this might have also had an influence on the epidemiology and percentage of cases gastrointestinal presented. However, to the best of the knowledge, data is lacking from the Indian scenario.

CONCLUSION

This study thus concludes that even though the gastrointestinal system is never considered critical to life, gastrointestinal manifestations in dogs indicate a moreserious under lying systemic pathology that warrants systematic investigations and based on the findings of this study both primary GI and non-GI diseases need to be addressed simultaneously.

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