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RESEARCH ARTICLE

Analytical Study of Fecal Sample and USG on Prevalence of Complex Inflammatory Bowel Disease (IBD) Along with Effect of Various Therapeutic Agents in Canine Pets of India

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ABSTRACT

The present analytical study was undertaken to assess the prevalence, diagnosis, and therapeutic management of Complex inflammatory bowel disease (IBD) in canine pets under Indian conditions, conducted between June 2021 and May 2024 at the veterinary clinical complex, WBUAFS, Kolkata and selected private clinics surrounding Kolkata, West Bengal. The study screened 29,733 dogs, of which 3,513 exhibited digestive ailments, and 224 were confirmed IBD cases through hematological, biochemical, and fecal biomarker analyses. Eighteen Labrador Retrievers were selected for detailed therapeutic trials and evaluated using fecal examinations and ultrasonography. The study identified *Ancylostoma* spp. as the most prevalent helminth, followed by *Toxocara* and *Trichuris* species, while *Salmonella* spp. was the predominant bacterial pathogen. Ultrasonography effectively detected gut wall thickening and loss of layering characteristic of IBD. Therapeutic evaluation revealed that conventional drugs such as prednisolone, tylosin, and metronidazole significantly reduced fecal calprotectin levels, though long-term use was associated with side effects. Conversely, Ayurvedic herbal preparations containing *Aegle marmelos*, *Cyperus rotundus*, *Punica granatum*, and *Holarrhena antidysenterica* demonstrated comparable or superior efficacy in reducing intestinal inflammation and restoring gut health, without adverse effects. The study concludes that integrating herbal therapies with modern treatment protocols provides a safe, sustainable, and holistic approach for managing canine IBD. These findings contribute valuable insights into diagnostic, epidemiological and therapeutic aspects of IBD, emphasizing the importance of combining traditional and evidence-based veterinary practices for enhanced animal health and welfare.

Keywords: Analytical, complex, inflammatory bowel disease, pets, prevalence, therapeutic, ultrasound, etc.,

INTRODUCTION

Dogs have long been trusted companions of humans, evolving from working animals to valued family members across all social strata in India. With the growing culture of pet ownership, canine health issues, particularly digestive disorders, are increasingly recognized as major clinical concerns. Inflammatory bowel disease (IBD), a chronic and complex intestinal disorder, has emerged as one of the most prevalent conditions affecting pet dogs, leading to persistent vomiting, diarrhea, abdominal pain, and nutrient malabsorption. Accurate diagnosis and effective management are essential

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to improving animal welfare. The present analytical study focuses on assessing the prevalence of complex IBD in canine pets through detailed fecal examinations and ultrasonographic evaluations. It further investigates the therapeutic efficacy of various treatment regimens, providing comparative insights into clinical recovery and intestinal health restoration, thus contributing valuable diagnostic and therapeutic perspectives for managing IBD in dogs under Indian conditions.

MATERIALS AND METHODS

The present analytical investigation was conducted over 4 years (June 2021–May 2024) at the veterinary clinical complex, Departments of Veterinary Medicine, Surgery and Radiology, and Biochemistry, Faculty of Veterinary Science, WBUAFS, Kolkata, and selected private clinics. A total of 29,733 dogs were screened for digestive disorders based on clinical symptoms and history, of which 3,513 showed digestive ailments. Out of these, 224 dogs were confirmed with IBD through hematological, biochemical, and fecal biomarker analysis. Eighteen Labrador Retrievers (6–12 years) showing elevated erythrocyte sedimentation rate, C-reactive protein, and fecal calprotectin levels were selected for therapeutic trials. Fecal analyses were performed for bacterial isolation, parasitic ova detection by Soulsby (1982), and calprotectin estimation using the Diazyme assay. Ultrasonography was conducted using a Siemens 5 MHz transducer as per Nyland *et al*. (2002) to assess hepatic and gastrointestinal alterations. Dogs were divided into three treatment groups (CVP, ADMD, and ADSD) and treated for 28 days. Statistical analysis using IBM SPSS® version 20 employed analysis of variance and Tukey's HSD tests, considering $P < 0.05$ significant and $P < 0.01$ highly significant.

RESULTS AND DISCUSSION

Fecal Sample Analysis: Cal Protectin (CALP)

The study in Table 1 explain the effect of different treatments on CALP (U/L) levels of sick dogs is compared group wise, on day 0, the values of CVP group (12.35 ± 4.38 U/L), ADMD group (15.20 ± 2.87 U/L) and ADSD group (10.41 ± 4.08 U/L) were observed to be significantly ($P < 0.01$) higher than healthy Control group (5.28 ± 1.32 U/L). Among the three treatment groups, values of CVP group (day 0:12.35 ± 4.38 U/L, day 14:9.30 ± 3.55 U/L, day *28:7.05* ± 3.12 U/L) and ADSD group (day 0: 10.41 ± 4.08 U/L, day 14: 8.00 ± 4.32 U/L, day 28: 6.51 ± 3.12 U/L) showed a trend of significant ($P < 0.01$) decrease from day 0 to day14 and fromday14 to day 28. On day 28, the values of CVP group (7.05 ± 3.12 U/L) and ADSD group (6.51 ± 3.12 U/L) were observed to be in the same range of healthy Control group *(4.46* ± 1.18 U/L) but on the same day value of ADMD group (15.46 ± 1.30 U/L) showed significantly ($P < 0.01$) higher values than healthy Control group. The use of metronidazole, tylosin, and prednisolone not only helps manage the clinical signs of IBD but also significantly reduces fecal calprotectin levels, indicating a decrease in intestinal inflammation. Similar findings were confirmed by Mansell and Peachey (2017), Sullivan *et al*. (2018), Bäumer *et al.* (2020), Suchodolski *et al*. (2021) and Farah *et al.* (2021). Traditional herbal remedies such as *Aegle marmelos*, *Cyperus rotundus*, *Punica granatum*, and *Holarrhena antidysenterica* show promise in managing inflammation and potentially lowering calprotectin levels and this multifaceted approach can enhance the management of canine IBD and improve the quality of life for affected dogs which is observed by Mishra *et al.* (2015), Bhatia *et al.* (2016), Ranjan *et al.* (2020), Shukla *et al.* (2020) and Suchodolski *et al.* (2021).

Prevalence of IBD in Dogs in Respect of Different Types of Causes (Total no. of Dogs-3513)

The results from the Table 2 of the study involving 3,513 diarrheal cases provide a detailed breakdown of gastrointestinal (G.I.) infections and non-specific causes. Among these cases, 46.93% (1,649) were positive for G.I. parasitic infestations, 2.17% (76) tested positive for G.I. protozoa, and 23.72% (833) were attributed to G.I. bacterial infections. The remaining 27.18% (955) cases were classified as non-specific Diarrhea, with no identifiable pathogen. These findings highlight the significant prevalence of parasitic and bacterial infections in diarrheal cases and underscore the importance of

accurate diagnosis and appropriate treatment for effective management of G.I. infections. Similar findings were reported by Langella *et al*. (2021) and Jensine *et al*. (2024).

Prevalence of IBD in Dogs Due to Different Types of Pathogenic Helminths and Protozoa

The results from the Table 3 and graph of the study in 1,725 dogs revealed infections caused by various helminths and protozoa. Among the cases, 9.04% (156) were positive for *Trichuris* species, 12.52% (216) for *Toxocara* species, and 65.52% (1,130) for *Ancylostoma* species, which had the highest prevalence. Additionally, 8.52% (147) of cases were positive for *Diphyllobothrium* species. Protozoan infections were identified in 4.42% (76) of the cases. These results highlight the significant role of *Ancylostoma* species as a major contributor to IBD in dogs, followed by *Toxocara* and *Trichuris* species. Similar observations were made by Bhatnagar *et al*. (2019), Little *et al*. (2019) and Palmer *et al*. (2021) by providing a detailed analysis of the prevalence of helminths and protozoa in dogs with IBD, focusing on the major species *Ancylostoma*, *Toxocara*, and *Trichuris*. Similar results were also observed by Ahmed *et al*. (2009), Kumari (2019), Desai *et al*. (2020).

Prevalence of IBD in Dogs Due to Different Types of Pathogenic Bacteria

The study of Table 4 for IBD in 833 Nos of dogs highlights significant bacterial involvement. Among the cases, 48.98% (408) tested positive for *Salmonella* spp., making it the most prevalent bacterial pathogen. This was followed by 35.89% (299) positive cases for *Staphylococcus* spp. and 15.13% (126) positive cases for *Escherichia* spp. These findings emphasize the critical role of bacterial infections, particularly *Salmonella* spp., in the development of IBD in dogs, highlighting the need for targeted diagnostic and therapeutic interventions. Sharma *et al*., (2020) and García-Bellón and Pérez (2021) highlighted bacterial infections like *Salmonella*, *Staphylococcus*, and *Escherichia* in the context of IBD in dogs, providing insights into their role in disease progression. Studies conducted by Fitzgerald *et al*. (2010), Guma *et al*. (2023), and Yu *et al*. (2023) support the findings of the present study.

Intestinal Ultrasonography for IBD in Canine Pets (Figures 1 and 2)

An increasingly popular method for identifying and tracking individuals with IBD is intestinal ultrasonography. It is an easy-to-use, low-cost, safe, and dependable method for tracking IBD patients. When determining the degree and severity of IBD and its consequences, this method offers an excellent diagnostic accuracy. Gut wall stratification, color Doppler flow, thickness of the gut wall, and peri-bowel inflammation are the most often employed parameters (Nagarjana and Bhat, 2024). The normal wall thickness of the intestine is 2–3 mm, which is increased in inflammatory diseases.

When imaging the gastrointestinal tract, the two methods most frequently employed are survey radiography and ultrasound (USG). It is crucial to keep in mind that these offer supplementary data and do not conflict with one another. Before a sonographic examination, survey abdominal radiographs should be obtained to rule out any visible obstructions or radio-opaque foreign bodies and to prevent artefacts from leftover USG gel on the skin. These steps will help determine a potential diagnosis (Mannion, 2008). There are five sonographically observable layers that make up the wall of the gastrointestinal system (Figs 1 and 2). These layers are alternatingly hyper and hypoechoic. The ability to distinguish between all five layers will depend on the luminal content, particularly gas, and the resolution of the equipment being employed (Barr and Gaschen, 2011). The gut wall has an overall hypoechoic appearance due to the predominance of the mucosal layers and hypoechoic muscularis. Because there is more fibrous connective tissue in the submucosa and serosa, these layers are more echogenic. IBD, namely, lymphocytic-plasmocytic enteritis, has been known to cause a modest thickening of the intestinal wall along with changes in mucosal echogenicity and a loss of layering. There could be a lack of definition and clarity in the intestinal loops (Nyland and Mattoon, 2002).

Efficacy of Ayurvedic Herbal Drugs as Therapeutic Agents on IBD of Canine Pets

The results of the present study (Tables 5 and 6) demonstrate that the therapeutic efficacy of Ayurvedic herbal components, including the raw fruit pulp of *A. marmelos* (Bael), root tuber of C. rotundus (Nutgrass), fruit seed o*f P. granatum* (Dadimba) and bark of *H. antidysenterica (*Kutaja*)*, surpasses that of conventional allopathic medicines such as Prednisolone, Tylosin, and Metronidazole in treating IBD. This is evident in various aspects discussed in the study.

Table 1: Effect of the different treatments on CALP (U/L) (mean±SD) of different four groups of dogs

	Cal-protectin		
Treatment	**0 days**	**14 days**	**28 days**
Control	5.28±1.32^{b}	4.36±1.17^{b}	4.46±1.18^{b}
CVP	12.35±4.38^{a}	9.30±3.55^{b}	7.05±3.12^{b}
ADMD	15.20±2.87^{a}	15.00±3.14^{a}	15.46±1.30^{a}
ADSD	10.41±4.08^{ab}	8.00±4.32^{b}	6.51±3.12^{b}
P-value	<0.001**	<0.001**	<0.001**

**Significant at 1% (P<0.01) level; N.B: Different superscripts (column-wise) differ significantly according to Tukey's HSD test for multiple comparisons. SD: Standard deviation

The treatment schedule followed in case of IBD in dog with Prednisolone tablet showed improvement of normalizing different parameters. Similar studies were recorded by Dye *et al.* (2013), Cissell *et al.* (2019), Hagman (2020), Xenoulis *et al.* (2022)., who highlighted the use of corticosteroids, particularly prednisolone for managing moderate to severe IBD in dogs. They discussed the effectiveness, therapeutic benefits, and potential risks, including immune suppression, gastrointestinal side effects, and long-term metabolic impacts of Prednisolone.

The treatment schedule using tylosin powder in managing canine IBD has shown significant improvement in clinical parameters. Studies by

Table 2: Prevalence of IBD in dogs in respect of different types of causes (Total no. of Dogs-3513)

No. of cases positive to gastrointestinal parasites	Percentage	No. of cases positive to gastrointestinal protozoa	Percentage	No. of cases positive to gastrointestinal bacteria	Percentage	No. of Non-specific Diarrhea cases	Percentage
1649	46.93	76	2.17	833	23.72	955	27.18

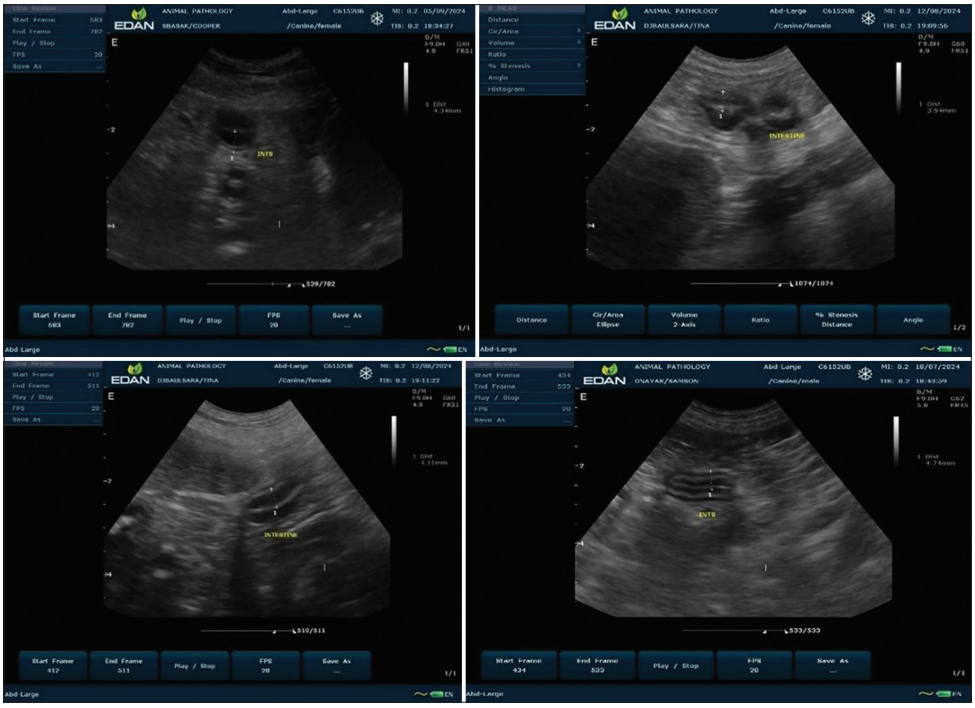

Figure 1: Ultrasonographic images show a cross-section of the intestine of 7 years 7-year-old female Labrador with increased wall thickness (more than 3 mm), especially the hypoechoic muscularis and mucosal layers, suggestive of inflammatory bowel disease

Suchodolski (2009) and Honneffer *et al.* (2014) confirmed the beneficial effects of Tylosin in normalizing gut microbiota and alleviating symptoms of gastrointestinal inflammation in dogs. Prolonged use causes and shifting the gut microbial community, potentially leading to dependency or decreased microbiota diversity.

The treatment schedule using metronidazole tablets in managing canine IBD has shown significant improvement in clinical parameters. The studies corroborate with the findings of Suchodolski *et al.* (2015) and Langlois *et al.* (2020) supported that while metronidazole helps to control acute symptoms by reducing bacterial load, it does not address the underlying chronic inflammation associated with IBD and even disrupts the gut microbiota in the long term.

In the treatment of canine IBD, combined therapy with prednisolone, tylosin, and metronidazole is commonly employed to manage inflammation, bacterial overgrowth, and infections hitherto with the efficacy, but with several side effects as observed as follows.

Prednisolone, as a corticosteroid, helps control inflammation by suppressing the immune response. Long-term use causes significant side effects such as polydipsia, polyuria, weight gain, muscle wasting, and immune suppression, with the need for careful monitoring of gastrointestinal and hepatic changes (Dye *et al*., 2013).

Tylosin, a macrolide antibiotic, targets bacterial overgrowth and may help correct symbiosis in the gut. While it improves symptoms in antibiotic-responsive enteropathies, prolonged use led to antibiotic resistance, gastrointestinal upset, and further disruptions in the gut microbiome (Suchodolski, 2009; Honneffer *et al*., 2014).

Metronidazole, with its antibacterial and anti-inflammatory properties, is effective against anaerobic bacterial infections in IBD. It reduces inflammation but causes neurological side effects like seizures and ataxia with long-term use. Its potential interactions with other medications also require careful dosage adjustments and monitoring (Langlois *et al*., 2020).

While these treatments can be effective in managing IBD, their combined use requires close veterinary monitoring to balance therapeutic benefits with the risk of side effects. Regular follow-up, blood tests, and dosage adjustments are essential for minimizing risks and ensuring optimal treatment outcomes.

Table 3: Prevalence of IBD in dogs due to different types of pathogenic Helminths and Protozoa (Total no. of Dogs-1725)

Name of parasites	Frequency	Percentage
Trichuris species	156	9.04
Toxacara species	216	12.52
Ancylostoma species	1130	65.52
Diphyllobothrium species	147	8.52
Protozoa	76	4.40

Table 4: Prevalence of IBD in dogs due to different types of pathogenic bacteria (Total no. of Dogs-833)

No. of cases positive to *Salmonella* spp.	Percentage	No. of cases positive to *Staphylococcus* spp.	Percentage	No. of cases positive to *Escherichia* spp.	Percentage
408	48.98	299	35.89	126	15.13

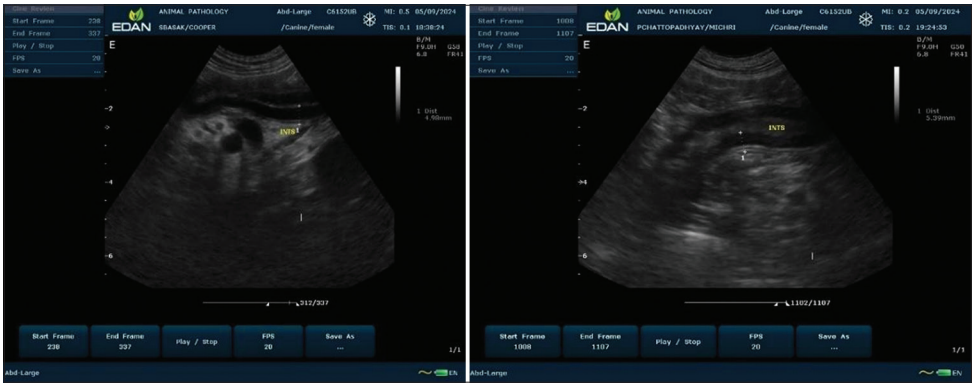

Figure 2: Ultrasonographic images show a sagittal view of the intestine of 7-year-old female Labrador with increased wall thickness (more than 3 mm), especially the hypoechoic muscularis and mucosal layers, suggestive of inflammatory bowel disease

Table 5: Representation of Group-wise treatment regimens

Group	No. of animals	Treatment	Route of administer	Major composition	Course of treatment
Control Group I	06	The healthy animals were given no treatment			
Group CVP Group II	06	1. Prednisolone tablet 2. Tylosin powder 3. Metronidozole tablet	Orally	1. Prednisolone 2. Tylosin 3. Metronidozole	28 days
Group ADMD Group III	6	With formulated herbal medicines (with minimum dosage @ 2.705 g/10 kg of body weight i.e., half of the recommended dose)	Orally	1. Raw fruit pulp of *Aegel marmelos* 2. Root tuber of *Cyperus rotundus*, 3. Fruit seed of *Punica granatum*, 4. Bark of *Holarrhena antidysenterica*	28 days
Group ADSD Group IV	06	With formulated herbal medicines (with standard dosage @ 5.41 g/10 kg body weight) as recommended by Paget, G.E. and Barnes, J.M. (1964)	Orally	DO	28 days

Table 6: Composition and dosage of drug used in Group II

Name of the medicine	Composition per tablet	Trade name and name of the manufacturing company	Dosage	Course of treatment
Prednisolone tablet	Prednisolone	Petpred-20 mg (Sihil Pharma)	• 2 mg/kg body weight (for a duration of 2 weeks) and tapered by • 1 mg/kg body weight (for a duration of next 1 week) • 0.5 mg/kg body weight (for a duration of next 1 week)	28 days
Tylosin powder	Tylosin	Solutyl- 25 g (Venky's)	• 15 mg/kg body weight thrice daily	
Metronidazole tablet	Metronidozole	Metropet-250 mg (Petfarm Global)	• 10 mg/kg body weight twice daily	

The combined use of herbal components such as *A. marmelos* (Bael), *C. rotundus* (Nutgrass), *P. granatum* (Pomegranate), and *H. antidysenterica* (Kutaja) has shown significant potential in managing IBD due to their complementary anti-inflammatory, antimicrobial, and gut-protective effects without side effects as observed.

A. marmelos (Bael): *A. marmelos* is renowned for its anti-inflammatory and gastroprotective properties. Active compounds like *quercetin* and *gallic acid* in Bael help reduce oxidative stress and inflammation in the gut while safeguarding the gastrointestinal lining. These effects make Bael an effective herb in managing gut health. According to Lambole and Murti (2010) and Sekar *et al*. (2011), Bael's pharmacological properties have been shown to benefit gastrointestinal conditions, making it a useful adjunct in treating IBD.

C. rotundus (Nutgrass): *C. rotundus* demonstrates notable anti-inflammatory and antimicrobial effects, which are relevant for managing IBD. Research by Babiaka *et al.* (2021) suggests that its phytochemicals can help modulate immune responses and alleviate gut inflammation. While direct studies on IBD models are limited, this herb may be beneficial in managing gut symbiosis, a condition commonly observed in IBD patients. Nut grass supports the balance of gut microbiota and reduces inflammation, thus aiding in IBD management.

P. granatum (Pomegranate)*:* Rich in antioxidants such as ellagic acid, *P. granatum* has been shown to improve gut barrier function and reduce inflammatory cytokines. Studies by Hering *et al.* (2021) and Gabbiadini *et al.* (2023) highlight pomegranate's ability to fortify the intestinal barrier and promote mucosal healing. These effects are crucial in managing IBD by preventing the breakdown of the intestinal lining and reducing overall inflammation, making pomegranate an essential component in IBD treatment.

H. antidysenterica (Kutaja)*: H. antidysenterica*, traditionally used for managing gastrointestinal disorders, contains alkaloids and flavonoids with antimicrobial and anti-inflammatory effects. Research by Jamadagni *et al*. (2017) and Tiwari *et al*. (2023) highlights its potential in managing IBD by restoring gut health and reducing inflammation. This herb's ability to treat digestive distress and inflammation makes it a valuable adjunct to conventional IBD therapies.

Together, these herbs offer a multi-faceted approach to treating IBD. By working synergistically, they reduce inflammation, support gut health, and restore the intestinal microbiome, providing a valuable natural adjunct to substitute conventional therapies. Given the potential risks associated with long-term use of conventional therapeutic agents like Prednisolone, Tylosin, and Metronidazole, herbal components such as *A. marmelos* (Bael), *C. rotundus* (Nutgrass), *P. granatum* (Pomegranate), and *H. antidysenterica* (Kutaja) offer a promising, safer alternative. These herbs provide anti-inflammatory, antimicrobial, and gut-protective properties without the significant side effects like that of steroids and antibiotics. Their use could potentially reduce reliance on conventional drugs, promote a healthier gut microbiome, and provide a more holistic approach to managing IBD in dogs. Integrating herbal remedies could help to minimize long-term complications and promote overall better health for affected animals.

CONCLUSION

The present analytical study highlights the growing concern of IBD among canine pets in India, revealing a significant prevalence linked to parasitic, bacterial, and non-specific gastrointestinal infections. Diagnostic evaluations through fecal analysis and ultrasonography proved highly effective in identifying intestinal inflammation and structural alterations. Comparative therapeutic trials demonstrated that while conventional treatments using prednisolone, tylosin, and metronidazole effectively reduced clinical symptoms and fecal calprotectin levels, their prolonged use carried potential side effects. Conversely, Ayurvedic herbal formulations containing *A. marmelos*, *C. rotundus*, *P. granatum*, and *H. antidysenterica* exhibited superior efficacy in alleviating inflammation and restoring gut health without adverse reactions. These findings emphasize the potential of integrating herbal therapy with conventional medicine for safer and more sustainable management of canine IBD. Overall, the study provides valuable diagnostic and therapeutic insights for improving the welfare and quality of life of affected dogs under Indian conditions.

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