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Research Article

Observational Study of Small Animal Practitioners' Awareness, Clinical Practice and Experience With Fecal Microbiota Transplantation in Dogs



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Keywords:

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A B S T R A C T

To assess small animal practitioner's awareness of the relatively novel procedure of fecal microbiota transplantation (FMT) in dogs and their practices, indications, experience and assessment of outcome of this in canine patients. An anonymous online questionnaire was distributed to practitioners in the UK and around the world, assessing demographics of respondents, their selection criteria for donors, their operating procedures and indications when performing FMT in dogs, as well as the observed outcomes. Analysis of results was descriptive. Data based on 155 responses from 13 different countries, 40% from primary care practices and 60% from referral hospitals, were analyzed. The majority of respondents (71%) had never performed FMT. For the remaining, main indications were chronic enteropathy (64%) and parvovirus infection (21%), followed by other types of acute diarrhea (15%). The most common mode of administration was via enema (79%) or endoscopically (55%), using fresh (76%) or frozen (46%) preparations mixed with saline and/or water, while the amount administered was extremely variable. Median storage time of FMT was 90 days (range 1–180 days). 67% of participants routinely administer FMT more than once. Clinical response was mixed to good, with rare adverse events ($n = 4$). A total of 25 respondents (21.7%) wanted to start using FMT, while 45 (29%) wanted to continue or increase FMT administration for various gastrointestinal conditions. In conclusion, an administration of FMT to dogs is currently rare amongst small animal practitioners, but generally follow current recommendations. Urgent consensus regarding donor selection and FMT application procedures for dogs is required.

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Introduction

Fecal microbiota transplantation (FMT) consists of the administration of feces from a healthy donor into the gut of a diseased recipient with the aim to modulate or replace the recipient's intestinal microbiota.¹ This medical technique has gained popularity and approval for use in human patients with *Clostridioides difficile* infection for a number of years.⁷ In addition, the benefits of FMT continue to be assessed in the treatment of various gastrointestinal (GI) and non-GI disorders in people.^{4,11,16}

In veterinary medicine, therapeutic transfer of GI content has been documented for centuries, for example in cattle (so called rumen transfaunation),⁶ but has only recently gained interest in small animal gastroenterology. The procedure can be performed by administering FMT "slurries" prepared on site via enema, endoscopy, or nasogastric tube.¹ In addition, some preparations are commercially available, either as a "do it yourself" kit for filling oral capsules (mostly from the human market), or as small animal species-specific "microbiome-pills" which can contain fresh or freeze-dried preparations derived from the gut microbiota. However, while there are a number of theoretical benefits to the procedure (e.g., support of the mucosal immune system, maintenance of mucosal barrier and homeostasis, resistance to colonization with pathogens),¹ to date only a few peer-reviewed scientific papers establish the true value of FMT in the treatment of canine GI diseases. In addition, no universally accepted or "best practice" protocol regarding any specific indication, the preparation and administration of FMT has been established in dogs, and both donor and recipient selection is likely to vary hugely

based on geographical variation in infectious and non-infectious GI diseases and other factors. There is some preliminary evidence that FMT administered via enema is beneficial in acute GI disorders like parvovirus infection.¹² Also, FMT was superior to metronidazole in treatment of acute enteritis, especially with regards to restoring dysbiosis.³ The effects of FMT in chronic gastrointestinal disorders like canine chronic enteropathy (CCE) is much less well documented, with existing data consisting of case reports and small case series.^{3,8,10,13–15} Some of these seem to document a beneficial effect of FMT.

While preliminary guidelines are emerging,^{1,2} it seems likely that awareness of practices surrounding the administration of FMT is extremely variable amongst small animal practitioners. FMT is easy to perform and extremely cost effective, as it doesn't require any specialist equipment or expertise (especially if given as an enema, not with endoscopic guidance), which means it is possible that it is used frequently in primary care practice settings, which could be a valuable additional source of information.

The aim of this observational study was hence to establish the level of awareness and frequency of administration of FMT to dogs amongst small animal practitioners, to assess indications of its use, and describe current practices and operating procedures surrounding this technique as well as observed success rates and outcomes.

Materials and methods

A commercially available web-based survey tool¹ was used to create a questionnaire consisting of a total of 10 questions and relevant follow-up questions where appropriate (see supplement 1).

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¹See: www.jisc.ac.uk; formerly called Bristol Online Survey (BOS).

Questions covered 3 main sections: The demographics and work-environment of the respondent (i.e., country of residence, small animal or mixed practice, primary care or specialist setting, estimated number of canine patients with acute or chronic GI problems), experience and practice procedures around the FMT technique (how many are performed, for which indications, how is the FMT prepared and administered, donor characteristics) and outcome or perceived response of the FMT recipients (response rate, duration, adverse effects, planned future uses). On several occasions, questions allowed the option of "other" answers including free-hand text to give explanations or descriptions of the answers chosen.

The link to the questionnaire was distributed amongst small animal practitioners in a variety of ways: Email addresses from small animal practices throughout the UK were collated from publicly available sources, resulting in 1881 possible respondents. In addition, a public call asking small animal practitioners to fill in and distribute the survey was made through common social media portalsⁱⁱ and email list serves of both the Comparative Gastroenterology Society (CGS) and the European Society for Comparative Gastroenterology (ESCG). Respondents were asked that only 1 answer per practice, practice group or hospital department is submitted. Ethical approval for this study was obtained prior to this by the institutional Human Ethical Review Committee (HERC), using approval number HERC#588-20. All answers were collected anonymously. The online questionnaire opened to respondents on the October 27, 2020 and closed on the July 1, 2021. Reminder emails and messages were sent twice during this time period via the routes described above to increase number of respondents. Descriptive analysis of responses is automatically provided by the questionnaire tool.

Results

A total of 115 responses were received, with the majority of respondents (n = 60; 52%) from the United Kingdom, followed by the United States of America (n = 20; 17%), Italy (n = 11; 9.6%) and France (n = 6; 5%). Germany, Greece and Sweden provided 2 answers each (1.7% each) and 1 response was from each of the following countries: Denmark, Ireland, Netherlands, Portugal, Russia, Switzerland. Forty-two of the respondents worked in primary care practice, and another 42 in a private referral hospital (36.4% each), 20 (17.4%) in academic referral hospitals and 3 selected "other", which consisted of 2 freelancers (1 endoscopy and 1 cardiology mobile service, respectively) and 1 person locuming 25% of their time. The majority of respondents described a case load of 0%-25% acute canine GI cases (n = 78; 68%) and 0%-25% of chronic canine GI cases (n = 83; 72%).

The majority of respondents had never performed a FMT procedure (n = 82; 71%), while the remaining colleagues had performed FMT 1-10 times (n = 21; 18%), 11-25 times (n = 9; 8%) or >25 times (n = 3; 3.6%). Hence the subsequent analysis and description of FMT practices and outcome is based on 33 available responses, which were mostly from North America (n = 9 USA, 1 working in both the USA and Canada) and the UK (n = 6), followed by Europe (Italy n = 5, France n = 4, Sweden n = 3, and 1 each from Denmark, Germany, Greece and the Netherlands) and 1 from Russia. Of these, 23 respondents worked at private referral hospitals, 9 at academic institutions and/or universities and 1 in primary care practice. They were mostly part of specialist teams (internal medicine n = 17, Emergency and Critical Care n = 8, endoscopy providers n = 4), while 3 (2 from Sweden, one from the UK) were not.

The main indication for FMT as a therapy was CCE (n = 21; 64%), followed by parvovirus (n = 7; 21%), Small Intestinal Bacterial Overgrowth (SIBO) and/or bacterial infection (n = 2; 6%), hemorrhagic gastroenteritis and/or Acute Hemorrhagic Diarrhea Syndrome (AHDS)

Table 1

Secondary ("Other") Indications for the use of Fecal Microbiota Transplantation (FMT) Besides the Main Indication Given by Questionnaire Respondents

Secondary indication for use of FMT	Number of responses (n)
Small Intestinal Bacterial Overgrowth or bacterial infections	14
Chronic enteropathy/ inflammatory bowel disease	11
Protein-losing enteropathy	9
Acute idiopathic diarrhea/ vomiting (adult dogs)	7
Hemorrhagic gastroenteritis/ acute hemorrhagic diarrhea syndrome	7
Idiopathic diarrhea in puppies	6
I only use FMT for the main indication already mentioned	5
Viral infections (i.e., parvovirus)	4
Adjunctive treatment for weight loss	1
Adverse drug reactions (e.g., chemotherapy)	0
Other	0

Several Answer Options Were Possible.

(n = 2; 6%) and idiopathic diarrhea in puppies (n = 1; 3%). Only 5 responders reported using FMT for a single indication, while the rest listed several other secondary indications (Table 1).

The mode of administration was reported as via enema by 26 respondents (79%), followed by endoscopically into the duodenum (n = 9; 27%), endoscopically into the colon (n = 6; 18%) and 3 each for endoscopically into the ileum, orally via naso-oesophageal or nasogastric tube and "other" oral applications (n = 2 oral capsules). For this, 79% of respondents (n = 26) reported using fresh (stored < 24 hour) FMT preparations, followed by frozen FMT preparations (n = 15; 46%). Only a small number used FMT preparations stored for longer than 24 hour (n = 4; 12%), oral capsules (n = 1) or non-commercial freeze-dried FMT (n = 1). The fresh preparations were reportedly diluted with sterile water or saline (85%) or non-sterile water (19%), while diluting with glycerol was mentioned twice (6%).

FMT donor selection criteria are shown in Table 2. Specifically, drugs not allowed in donor dogs were antibiotics (n = 12), antacids (n = 2), immunosuppressants (n = 6), NSAIDs (n = 1), probiotics (n = 1) thyroid hormones (n = 1) and cytotoxic drugs (n = 1), while 2 people made more general statements (no drugs apart from vaccination and deworming). A total of 15 people (45%) reported having identified a so called "super-donor" (single universal donor with consistently good clinical results).

A large amount of variation was observed with regards to quantity of FMT prepared and administered, some responses given in ml/kg, g/kg or

Table 2

Criteria for Selection of Canine Donors for Fecal Microbiota Transplantation (FMT) as Selected by Respondents to the Questionnaire

FMT donor characteristic	Number of responses
Not on any medication/ drugs	37
Adult dog with no history of GI disease	32
Fecal screening by parasitology (e.g., flotation/sedimentation + Giardia antigen testing)	30
Not on raw (BARF) diet	28
Clinically healthy and from a different household than the recipient	19
Normal hematology/ biochemistry	14
Fecal dysbiosis index (commercial)	10
Fecal culture/ bacterial screen	10
Normal TLI, folate and/ or cobalamin	7
Clinically healthy from the same household as the recipient	5
Infectious disease titres/ blood PCRs	5
Fecal microscopy (in-house)	1
Fecal digestibility assessment	1
Normal Body Condition Score	1
I do not use FMT/ not applicable	75
I do not screen/ select the donors based on specific criteria	1

Multiple Answers Were Possible.

ⁱⁱSee: www.facebook.com; www.linkedin.com; www.twitter.com.

Table 3
Fecal Microbiota Transplantation (FMT) Preparation for Dogs as Described by 29 of the Questionnaire Respondents

Dose or concentration of FMT administered	Number of responses
Volume of FMT as ml/kg (recipient body weight)	
5 ml/kg	2
10 ml/kg	6
20 ml/kg	1
50 ml/kg	1
Total volume of FMT in ml	
20	1
30	1
50	1
Single "void" in 150-300 ml	1
300	1
Weight of FMT as g/ kg (recipient body weight)	
2 g/kg	3
5 g/kg	4
Total weight of FMT in g (diluted in total volume X where mentioned)	
1 g (in 50 ml)	1
10-15 g	4
30-50 g	1
50 g (in 250 ml water)	1
50 g in 50-80 ml of saline for dogs < 20 kg, 100 g in 100-150 ml saline for dogs > 20 kg	2

This was a Free Text Answer, With Some Respondents Giving More Than 1 Dose or Concentration.

as absolute quantities (g or ml). The most common answer was dilution of feces 1:4 with saline and application of 10ml/kg recipient body weight of this solution (Table 3). Seventeen comments on time of (frozen) storage of FMT preparations until considered no longer fit for use were received: median storage time was reported as 90 days (range 1-180 days).

While 22 of 33 respondents reported FMT to be routinely administered more than once to an individual recipient (67%), the number of repeat FMTs for a single recipient ranged from once every 24-48 hour or until clinical response was observed, 3-4 times within 14 days, once a week for 4 weeks, to every 2 weeks for 3-4 times. Two respondents mentioned that it varies on a case by case basis or on patient response, while 1 person described an initial endoscopic administration into the duodenum and ileum, followed by oral administration every 48 hours for 1-2 months. Rationales for repeated FMT included relapsing (n = 11) or persistent (n = 5) clinical signs, as well as perceived theoretical benefits like normalization of microbiota composition, a longer or improved efficacy, or better engraftment of transferred microbial communities (n = 7).

Clinical response was rated as "mixed (about 50% response rate)" by 17 (52%) respondents, followed by "good (>50 but < 90% response)" by 11 (33%); 9% (n = 3) reported an "outstanding response (>90% success)" and 6% (n = 2) a minor or negligible response. Adverse effects were observed by 4 respondents (12%), which consisted of worsening of diarrhea in all cases, with hemorrhagic diarrhea in 3 of 4 and additional flatulence in 1 of 4 dogs.

Of the 115 total respondents, 44 (38.3%) felt it was likely they would not use FMT in the future, while 25 (21.7%) wanted to start using it or continue to use it. A total of 20 participants (17.4%) wanted to use it more, and 1 person (0.9%) wanted to use it less and/or stop using it. For more details predicted indications for the use of FMT, 45 responses and 24 comments were received. Eighteen (40%) respondents would not change the indications for using FMT, 16 (35.6%) considered it for new or different conditions than previously, and 11

(24.4%) considered it for both. While 5 respondents were unsure what new indications might be and expressed a wish to learn more about FMT, "new" indications mentioned included chronic diarrhea and/or CCE (n = 8), antibiotic-responsive enteropathy (n = 4), dysbiosis (n = 2), refractory non-responsive CCE (n = 2), protein-losing enteropathy (n = 1), parvovirus (n = 2), and granulomatous colitis (n = 1). Only 1 respondent mentioned extra-GI diseases as possible indication (e.g., urinary disease).

Discussion

This is the first survey evaluating and describing perceptions, practices and outcomes surrounding the relatively novel treatment modality of FMT in dogs amongst primary care and specialists small animal practitioners. Overall, FMT is not widely performed, but where known, veterinarians tended to both adhere largely to available evidence and recommendations,^{1,2} namely the use as adjunctive treatment in parvovirus and CCE, as well as considering it as a novel treatment with potential benefits in other GI conditions. There are little recommendations regarding donor characteristics or infectious disease screening of donors, and an absolute lack of consensus regarding preparation, dosing and administration of FMTs to dogs, as reflected in the large variation of practice documented via this questionnaire. This needs to be urgently addressed to allow creation of comparable and large datasets for timely future analyses, especially if multi-center trials are conducted. As FMT is easy to perform and not very cost intensive, especially when given as an enema, there is a risk of this becoming a more wide-spread treatment attempt in a variety of conditions without the appropriate scientific backing. Current guidelines emphasize that a thorough workup of possible underlying diseases is still required, and it is encouraging that most respondents adhere to those guidelines.¹ It seems important to maintain the concept that FMT cannot and should not be a "one fits all" or even sole treatment approach, neither for acute and/or infectious or chronic GI conditions in dogs, underpinned by very mixed treatment responses documented here. It is intriguing to speculate how FMT could also be helpful in extra-GI conditions that are mediated via or having an impact on the intestinal microbiota, as currently evaluated in human medicine.^{5,9} The questionnaire did not include any detailed information about FMT in cats, but when asked, only 12% of respondents confirmed that they have already performed this in cats, where even less information about indications and response rates are available compared to dogs.

Conclusions

In conclusion, small animal veterinarians currently rarely use FMT as a treatment modality. There is a clear need for defined criteria regarding donor selection, indications and standard operating procedures for FMT preparation and administration. Future studies should also further investigate differences in clinical responses in both acute and chronic GI conditions. It would be interesting to assess how responses to this questionnaire will develop in the future, when more and more evidence for appropriate uses of FMT in both dogs and cats becomes available.

Author statement

Silke Salavati: Conceptualization, Methodology, Data Analysis, Writing- Original draft preparation, Writing- Reviewing and Editing

Conflict of Interest

The author declares no conflict of interest.

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Supplementary materials

Supplementary material associated with this article can be found in the online version at doi:[10.1016/j.tcam.2022.100630](https://doi.org/10.1016/j.tcam.2022.100630).

References

1. Chaitman J, Gaschen F. Fecal Microbiota Transplantation in Dogs. *Vet. Clin. Small Anim. Pract.* **51**:219–233, 2021
2. Chaitman J, Jergens A, Gaschen F, et al. Commentary on key aspects of fecal microbiota transplantation in small animal practice. *Vet. Med. Res. Reports* **31**:71, 2016
3. Chaitman J, Ziese AL, Pilla R, et al. Fecal microbial and metabolic profiles in dogs with acute diarrhea receiving either fecal microbiota transplantation or oral metronidazole. *front. Vet. Sci.* **7**:192, 2020
4. Choi HH, Cho YS. Fecal microbiota transplantation: current applications, effectiveness, and future perspectives. *Clin. Endosc.* **49**:257, 2016
5. Cibulková I, Rehořová V, Hajer J, Duška F. Fecal Microbial Transplantation in Critically Ill Patients-Structured Review and Perspectives. *Biomolecules* **11**:1459, 2021
6. DePeters E, George L. Rumen transfaunation. *Immunol. Lett.* **162**:69–76, 2014
7. Malinkowski T, Khanna S, Pardi DS. Fecal microbiota transplantation for gastrointestinal disorders. *Curr. Opin. Gastroenterol.* **33**:8–13, 2017
8. Murphy T, Chaitman J, Han E. ACVIM Forum Research Abstract #GI-31: Use of fecal transplant in eight dogs with refractory *Clostridium perfringens* associated diarrhea. *J. Vet. Intern. Med.* **28**:976–1134, 2014
9. Nandwana V, Debbarma S. Fecal Microbiota Transplantation: A Microbiome Modulation Technique for Alzheimer's Disease. *Cureus* **13**:e16503, 2021
10. Niina A, Kibe R, Suzuki R, et al. Improvement in Clinical Symptoms and Fecal Microbiome After Fecal Microbiota Transplantation in a Dog with Inflammatory Bowel Disease. *Vet. Med. Res. Reports Volume* **10**:197–201, 2019
11. Paramsothy S, Paramsothy R, Rubin DT, et al. Faecal microbiota transplantation for inflammatory bowel disease: a systematic review and meta-analysis. *J. Crohn's Colitis* **11**:1180–1199, 2017
12. Pereira GQ, Gomes LA, Santos IS, Alfieri AF, Weese JS, Costa MC. Fecal microbiota transplantation in puppies with canine parvovirus infection. *J. Vet. Intern. Med.* **32**:707–711, 2018
13. Pilla R, Suchodolski JS. The role of the canine gut microbiome and metabolome in health and gastrointestinal disease. *Front. Vet. Sci.* **6**:498, 2019
14. Sugita K, Yanuma N, Ohno H, et al. Oral faecal microbiota transplantation for the treatment of *Clostridium difficile*-associated diarrhea in a dog: A case report. *BMC Vet. Res.* **15**:11, 2019
15. Weese JS. ACVIM Forum Research Abstract #GI-28: Preliminary clinical and microbiome assessment of stool transplantation in the dog and cat. *J. Vet. Intern. Med.* **27**:604–756, 2013
16. Wortelboer K, Nieuwdorp M, Herrema H. Fecal microbiota transplantation beyond *Clostridioides difficile* infections. *EBioMedicine* **44**:716–729, 2019