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Original Paper

Fecal microbiota transplantation among dogs with several different diseases: retrospective cohort study between years 2011–2024

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Purpose of the retrospective, present study was to determine whether fecal microbiota transplantation (fMt) from well known, otherwise healthy lean donor dogs could be capable of substituting disease condition from disease to health status, reverting to factory settings and further might improve the life quality of dogs with several different diseases. Taking into account study design, setting and enrollment (along with accompanying archive data) this clinical trial was conducted between 2011 to 2024 among 1,885 diseased dogs with several different system involvement were treated with fMt at median number of 2 to 6 occasions. To those of solely eligible dogs (with witten owner consent, triage position, without systemic inflammatory respond syndrome or other hazardous condition) were recruited for the study. Data were analyzed from March 2011 to June 2024. All fMt interventions from each lean donor (heterologous) were administered either by gastroduodenoscopy (n = 112 into the duodenum) or by rectal enema (n = 1,773 into the colon). Available cure rates ranged from 41.42% to 93.61% regarding entire enrolled dogs. Forest plot denoted an overall response rate of 76%. Highest cure rates (nearly 94%) were deemed available for gastroentero-dermatological disorders to those of satisfactory clinical recovery for each cases enrolled. Lowest cure rates were observed for endocrinological and cardiovascular disease conditions exhibiting 41 and 47%, respectively. Available results were establishing future meta-analysis source in which data is lacking. This study should highlighten the efficacy and possible treatment switching modalities to those of uncurable diseases.

Keywords: dog, fecal microbiota transplantation, natural, treatment

1 Introduction

Fecal microbiota transplantation (fMt), has been well recgonized and described as a therapeutical solution comprising the transfer (with several different routes) of fecal material from an appearently healthy donor into a diseased recipient for the purpose of restoration of the balance regarding gut microbiota and improving clinical recovery. At November 2022 Food and Drug Administration has announced all stakeholders and beneficiary, with thier intention to describe fMt as 'investigational new drug application' especially against *Clostridioides difficile* infection among humanbeing. A brief description for the history of fMT goes back to 1) China in the fourth century, where it was firstly used through oral route (Zhang et al., 2012). Afterwards in 1958 fMt enema against pseudomembranous colitis, was the introduction for this technique into coventional medicine (Eiseman et al., 1958). This intervention briefly involved truly selection of a donor, preparation of obtained fecal material (in general mixed with water/normal saline), filtration (removing unnecessary particulates), and then administration through several different routes (Smits et al., 2013).

Herein at this manuscript comperatively, both the past and the future are in our concern regarding fMt interventions as because chronic degerenative diseases are exhibiting as a pandemic spread linked to gut microbiota, in our clinical practice. We, after 15 years of experience, should briefly said that for battling with leaky gut, small intestinal bacterial overgrowth [today we are strictly and tentatively diagnosing it with Sunvou® Breath Analyzer, Korea as we purchased, with special thanks to, by Governed/Regimented Project belonging to Aydın Adnan Menderes University, Research Funding Unit

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(denoting Aydın Adnan Menderes ADU-BAP) with project number VTF-24006], intestinal permeability/integrity etc., we have the capacity of performing large operations for fMt), with our large pool of donor feces at İPÖM unit. Prior to planning this study we hypothesized that the efficacy of fMt mighr depend on the status of the disease itself and efficacy might be challenging in relationship with disease activity orignated from different body sites and organs affected. The aim of the present retrospective study was to detect even if fMt from healthy lean donor dogs might be of beneficial and capable of substituting disease condition to health status, reverting to factory settings and further be able to modify life quality of dogs with several different diseases.

2 Material and Methods

2.1 Study Design, Settings and Participant Dogs

The study was conducted and started at 2011 March, in which actually the usage of fMt went back to 2007–2008 whereas archive data was not supportive, not included therefore at that era. Primary end point of the study was early 2024. The reserach took nearly 13 years of experience. At starting point of fMt; a case was referred to clinic with recurrent diarrhea, which was then diagnosed with inflammatory bowel disease, received fMt, from a well known healthy donor without any side effects. Methodology of fMt inervention (preperation and administration) was identical to that of published article (Ural et al., 2019) several years before.

2.2 Decision Tree for Detection of Number of fMT

Decision tree involved field triage. Animal Triage Procedures was selected and similary adopted from Wyoming Department of Health (Wingfield and Sally, 2009).

Number of cases involved at fMt based on triage color, in which was effectively influenced median fMT procedures frequency. Triage color black denoted dogs that might probably die regardless of the severity for care they receive, whereas coded color green meant dogs that might survive even if receive care, and finally red coded color exhibited dogs could benefit significantly from simple/pure interventions (Figure 1) (Wingfield & Sally, 2009).

2.3 Laboratory Interpretation

Diagnostic tree evolved necessary or relevant tests as follows in table 1.

2.4 Mehodology for fMt Intervention

fMT donor candidates were selected from Intestinal Permeability Measurement Center (IPÖM) archive (and to those of previous studies of the present authors' Feline Dermatology Group). Initially well secreened dog fecal samples were sent to the IPÖM for rapid monitorization against parasitic, infectious and other relevant diseases. If otherwise healthy, dogs were kept under control for several months, and some of the selected donor dog fecal material was sent abroad for gut microbiota analytes for several different timeline involved. Those well recognized dogs were also screened for a long while for any alteration regarding health status. If no disease condition was evident, and if gut microbiota analytes were evident, those were preferred for donor participation with wirtten owner consent. If possible (for some of those selected cases) Dysbiosis Index assessment and enteropathogen examination, were deemed available. Endoparasite screening was performed by a well team mate parasitology specialist at IPÖM facilities. Gastrointestinal, endocrinological, dermatological and other relevant laboratory examinations were fully developed (Table 2). All

Figure 1 Triage color of all cases were deemed enrolled at the present study
Coded colors were adopted from Wingfield and Sally (2009). Animal Triage Procedures Wyoming Department of Health Adapted from "Veterinary Disaster Triage: Making the Tough Decisions" Colorado State University

Table 1 All preferred diagnostic methodology herein evolved fort this study, was given briefly

Miscellaneous diseases	endocrinology, antinuclear antibody test, skin punch biopsy, *in vitro* ig E testing (Polycheck Allergy Test)
Gastroenterological involvement	endoscopy**, colonoscopy**, serum biochemistry, gastrointestinal panels, Sunvou® Breath Test Analyzer Device^
Dermatological disorders	CADESI-04 and other relevant scores, epidermal corneometric analysis, dermatoscopy with DL4, bioresonance scanning (Quantum® Pet Analysis Device), *in vitro* ig E testing (Polycheck Allergy Test), deep skin scrapping, skin cytology, food elimination trial
Infectious etiological analysis	point of care tests, PCR (Qmini PCR Testing*)
Endocrinological interpretation	total T4, plasma cortisol, urinary cortisol/creatinine ratio, sex steroids for atypic cushing etc.
Neurological interpretation	open mouth rostro-caudal oblique radiography, clinical signs, serum biochemistry, neurological examination

*Qmini PCR Testing was deemed available at Gaziemir Veterinary Polyclinics at İzmir; ** colonoscopy and gastroduodenoscopy were deemed available at Podovet Veterinary Polyclinics located at Aydin Municipality, near to Aydin Adnan Menderes University, Faculty of Veterinary; ^ADU-BAP VTF – 24006 Governed-Regimented Project

Table 2 Classification of dogs diseases enrolled along with median number of fMt, treatment outcome and case number with side effects noticed

	(*n* =)	Median number of fMt application per individual case	Treatment success (*n* =) (%)	Unpleasent side effects (*n* =)
Gastrointestinal issues	579	4	477 (82.38)	16
Gastroentero-dermatological disorders	642	6	601(93.61)	25
Neurological involvement	101	3	83 (82.17)	7
Hematological disorders	125	2	76 (60.80)	10
Endocrinological disease	140	2	58 (41.42) 27 cases were lost for follow up	11
Cardiovascular involvement	108	3	51 (47.22)	13
Pulmonary involvement	190	2	154 (81.05)	5

aforementioned tests were carried out in an attempt to exclude any probability of infectious pathogen transfer.

2.5 Preparation of Transfer Material for fMt

Fresh (instantly) fecal material obtained from the donor was withdrawn and prepared suddenly for relatively very short-term hold-up. In an attempt to prepare, available upmost fecal material was mixed with equivalent Lactated Ringers Solution and 3 mL glycerol in red tapped gastrointestinal plastic tubes. For a very short term (2–3 minutes) fecal materials were kept at room temperature and blended for obtaining a smooth consistency. Then were blended materials were then drawn by use of 50 mL syringes.

2.6 Procedures for fMt

The fecal dosage was 10 (Pereira et al., 2018) – 50 gr (observational findings and experience of first author, between the years 2011–2019) or 5 g (between 2019–2024) of feces·kg^{-1} (Chaitman et al., 2020; Watanangura et al., 2024) for each of the fMt sessions. The dogs were fasted for at least 12 hours, and the owners were adviced to fed low glycemic index dog food for at least 1 week prior to fMt. None of the dogs were induced for defecation prior to fMt. On the other hand even if any fecal material that was slurred or attached within the rectum were removed manually by the veterinary surgeon involved at this study. For every session of fMt (Ural et al., 2019), a Foley or routine rectal catheter (40 cm CH 25), was lubricated with pure olive oil oil and strictly attached to previously prepared syringe composing the blended donor feces organized. The fMt sample was initaly pushed onto the catheter for avoiding air contamination (Chaitman et al., 2020; Watanangura et al., 2024). At least 15 cm of the catheter length was throughly and gently manipulated and inserted through the rectum into the colon. Initially obtained syringes involving blend coctail, linked with the preferred catheter, were than injected into the colon (Ural et al., 2019). As all animal owners were informed, no anesthesia was given. All dogs were kept at the IPÖM facility for at least 30 minutes, without giving permission for probable defecation, were

then discharged. In an attempt to prevent defecation, food and activity were restricted for 6 h following fMt (Chaitman et al., 2020) Alternatively gastroduodenoscopy (n = 112 into the duodenum) were deemed available by use of endoscopic device (Table 2) with similar steps to enema, in which fMt material was drilled to duodenum via endoscopic intervention. On repeated fMt sessions, at least 48–72 hours were ceased.

2.7 Statistical Analyses

Statistical analyses were conducted using R Studio (version 4.1.2). We performed a subgroup analysis to evaluate treatment success rates across different conditions, visualizing the data using a forest plot. The treatment success rates and their 95% confidence intervals were calculated for each condition. A random-effects model was applied to account for variability. The overall effect was represented by a red diamond marker, and heterogeneity between subgroups was assessed using the I^2 statistic. The forest plot displays the proportion of treatment success on the x-axis and the conditions on the y-axis, providing a clear comparison across different medical conditions. Statistical significance was determined at a 0.05 alpha level. This analysis provides a concise visualization of treatment effectiveness, aiding in the interpretation of outcomes.

3 Results and Discussion

In the present study in parallel line with the hypothesis 1885 dogs subclassfied to 7 different groups (table 2) were enrolled, in an attempt to search/investigate efficacy of fMt on different disease activities. Median number of fMt changed from at least 2 sessions (hematological, endocrinological and pulmonary involvement) to 6 sessions (gastroentero-dermatological diseases). As was hypothesized, different diseases of selected organ or anatomical sites of origin, exhibited different overall cure rates. Treatment success were highest in gastroentero-dermatological diseases among dogs (93.61%), comperatively dropped to 41.42% recovery rate in dogs with endocrinological disease activity. Population of dogs were different among selected disease which could have interfere with the results however overall number of dogs was very high during study ear of 13 years, supporting the starting point of hypothesis.

3.1 Cure Rates Exhibited by Forest Plot

Regarding case series had cure rates ranging from 41.42% to 93.61% (Table 2) compassing entire enrolled dogs. As shown with a forest plot (Figure 2) an overall response rate was 76%, altough 27 cases were lost for follow up in endocrinology group of cases. Highest cure rates (nearly 94%) were deemed available for gastroentero-dermatological disorders (table 2), to those of satisfactory clinical reovery for each cases enrolled nearly. Lowest cure rates were observed for endocrinological and cardiovascular disease conditions exhibiting 41 and 47%, respectively.

3.2 Demographic Data Relevant to Classification of Diseases

Demographic data involved 1885 dogs with underlying etiology determined via relevant tests were shown in table 2 below. Figure 2 showed selected cases denoting clinical outcome.

Subclassification of gastrointestinal issues involved both infectious (small intestinal bacterial overgrowth, parvovirus infection, giardiasis and other relevant parasitological invasion (i.e. worms)) or non-infectious (inflammatory bowel disease, acute gastroenteritis, exocrine pancreatic insufficiency) etiology. The latter etiological appearences were deemed the vast majority with observed reasons. On the other hand gastroentero-dermatological problems were evolved were frequently observed such as cutaneous adverse food reaction with or without demodicosis/sarcoptic mange, endocrinological co-morbidities, atopic dermatitis with inflammatory bowel disease, pyoderma with or without small intestinal bacterial overgrowth, metabolic issues etc. Hematological issues were addressed as commonly vector borne diseases with accompanying leukocyte, erythrocyte and thrombocyte abnormalities with unexplained fever. Neurological complication involved seizures, intoxication, vestibular disease and suspected cognitive disorders.

3.3 Triage Color Changes

At starting point of the study, as was shown in figure1, 302 cases were coded in red triage, 981 in black and other relevant 602 in green code. Following completion of the study 1,001 were in red triage, 807 in green and solely 77 in black codes.

3.4 We are we Now in Participating Fecal Microbiota Transplantation?

First of all we need to address that we as Feline Dermatology Unit and Intestinal Permeability Measurement Center (IPÖM) participate in several cases for fMt procedures for several years as leaders for the veterinary sector in Turkey. Some reviews (Chaitman & Gaschen, 2021), or research articles (Niiana et al., 2021; Rojas et al., 2024; Sugita et al., 2023; Toresson et al., 2023; Ural, 2022; Watanangura et al., 2024) took place in its position for the relevant literature for fMt. In the present study we aimed to add

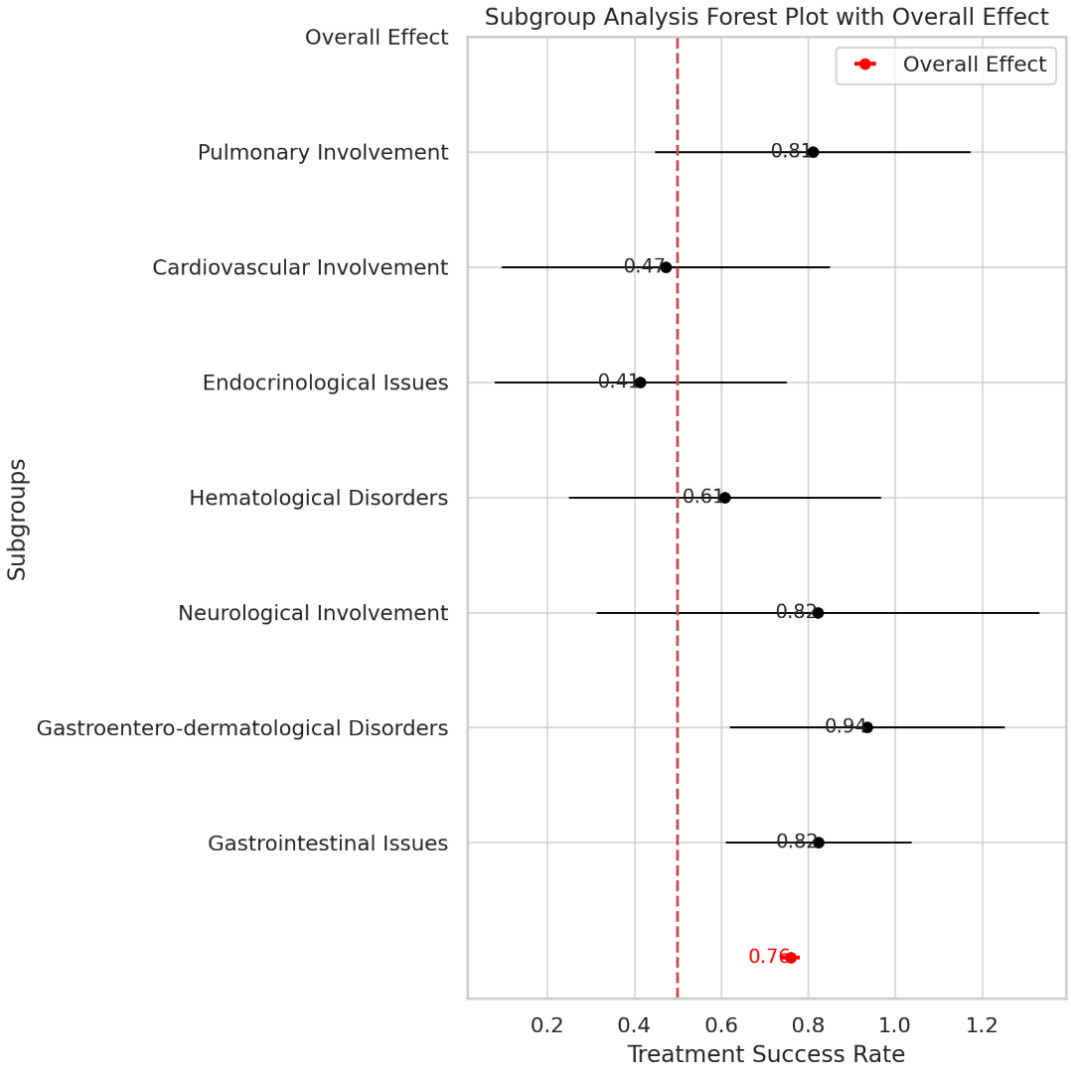

Figure 2 Forest Plot analytes showing the proportion of treatment success by condition, with 95% confidence intervals represented by error bars

scientific longitudinal data with an exteremely large dog population. Our results established at this study could serve as a step for meta analysis, going to be performed within the future. Apart from that cure rates should have helped field veterinary surgeons, also could encourage them to perform fMt for their self practice.

The gene make-up and utilitarian possessions of the entire intestinal microbiome throughly been investigated by use of an updated intestinal bacterium inquisitive procedure (Mukherjee et al., 2018). Several researches exhibited a link among dysbiosis (abnormal gut microbiome) and selected diseases (Arthur et al., 2012; Ceccarani et al., 2020; Frank et al., 2007; Karlsson et al., 2012; Mukherjee et al., 2018; Qin et al., 2012). In this context, fMt has been elucidated for improving gut microechology to those of diseased people/animals. Classically and briefly fMt application has been composed of fecal mass withdrawn from an appearently healthy (and tested if possible) donor, assorted with saline/relevant solution (to the present authors' practice Lactated Ringers Solution is suitable due to its very similar pH to the colon), strained to exclude particles (mostly hair and other solid particles), and administered to a patient by colonoscopy, endoscopy, sigmoidoscopy, or enema (Borody & Khoruts, 2011; Chaitman et al., 2016; Kelly & Tebas, 2018). Detailed data was given below in table 3 downwards. The infusion site varies with the administration route; for example, the injection site is the colon or cecum with colonoscopy, the duodenum with endoscopy, and the colon or rectum with enema (Borody & Khoruts, 2011; Chaitman et al., 2016; Kelly & Tebas, 2018; Quraishi et al., 2017). In the present study the vast majority of dogs received fMt via enema. However this was not a comperative study between infusion routes so that overall efficacy was not classified

into two different routes of administration. Also we need to mention that this kind of retrospective studies did not allow researchers to go back and analyze what did not involved in mind.

3.5 Abbreviated, but Generalized Literature Review for Frontier Knowledge on fMt

In a well designed systematic review and meta-analysis, which proposed that fMt is exceedingly effectual therapeutical armamentarium for recurrent/refractory *Clostridium difficile* infection (Quraishi et al., 2017). On the other hand while most conventional analysis supposed an estimation around 49% cure rate for fMt for a single transfer, other systematic reviews and meta-analyses dedicated significant positive outcome for *Clostridium difficile* infection somewhere between 88–92% (Kassam et al., 2013; Li et al., 2016), similar to Quraishi et al. (2017). In the present study, we planned, performed and reported herein, the overall efficacy was 76% (Figure 2) regarding several different disease and system disorders (altough cases that were lost for follow up were evident) for fMt applications.

3.6 Pros and Cons for fMT Procedures, at least for the Techniques Herein Used

Someone might, without any study performed or experienced skills at this subject, could speculate or criticise our results that we obtained as because of recovery rates were shown solely with forest plot, as was presented in figure 2. It has not been very easy to archive 1885 cases for several years data, however we strictly documented all cases that we performed by through examination data sheets and then were immediately transferred to digital platform. For instance dermatological diseases were archived prior to- and thereafter fMt application by comperative DermLite®DL4 Dermatoscopy, DermLite LLC, CA, USA) dermatoscopic investigation, epidermal corneometric analytes (Callegari Soft Plus Device®, Italy) cytology (if necessary), Quantum Quantum Pet Analysis Device®, China) (Table 2), which could allowed us to fullfill investigate clinical recovery. Moreover for both gastroentero-dermatological and gastrointestinal issues (Table 2) (for the era between March 2024–August 2024, during finalization of the study) several cases were subjected to Sunvou® Breath Analyzer, Korea (distributor from Turkey by RDA Group, Istanbul, Turkey) was obtained by a Governed/Regimented Project belonging to Aydın Adnan Menderes University, Research Funding Unit (denoting ADU-BAP) with project number VTF-24006. Briefly H2 and CH4 gasses emission were analyzed via 10-gr lactulose loading test. Furthermore exhaled breath (air) was transferred to air bags (at 0, 30, 60 and 90 minutes following the lactulose loading), which were then converted to Sunvou® Breath Analyzer for investigating gas Dynamics. This data was not necessary to show apart from fMt findings were relevant herein.

There has been several factors involved at efficacy of fMt in humans especially as was shown in table 3. Briefly as 1885 cases were deemed available at this large retrospective study, it is unpossible to standardize diet habbits of cases, however during fMt trials all cases were subjected to the lowest carbohydrate diet for prevention of insuline repond and immune system activation. On the other hand two different routes of heterologue-fMt were deemed available as were administered either by gastroduodenoscopy (n = 112 into the duodenum) or by rectal enema (n = 1,773 into the colon) in this study. Someone might also criticise usage of two different routes, however the vast majority of 1885 dogs were subjected to rectal enema and fMt suspension was delivered to colon. The reason for this was the written owner consent and animal owner ejection for anesthesia and therefore gastroduodenoscopy. However another brief discussion is necessary about this issue. The cost of therapeutical intervention, the invasiveness character of the procedure and probable risk of adverse issues must be taken into consideration when deciding administration methodology. The present authors staff frequently used enema methodology for several long years because of fMt being less invasive procedure and due to clinicans hurry up for busy conditions (number of patients at all in a time, triage severity, animal owners behaviour and animal stability or unstable conditions etc.). Enema route for fMT exhibited positive sides:

a) might be operated at bedside,
b) requires at least few experience for the operator,
c) causes less side effects than colonoscopy (Marcella et al., 2021).

Besides enema methodology is less invasive in contrast to other routes, in which probably linked to less discomfort for donor (Skjevling et al., 2023). On the other hand as a negative interpretation, enema preferred for fMt, in comparison to to colonoscopy, is whether transferred material has reached cecum is questionable. This was highlighted with a prior study in that fMt was spread to at least to the transverse colon in the vast majority of patients, in which the researchers denoted that fMt with enema route must be followed by true positioning for improving therapeutic efficacy (Skjevling et al., 2023). In the present study all interventions were performed at natural position and dogs were stabilized in lateral recumbency for 5–10 minutes along with the pelvis raised to upwards, in an attempt to help diffusion of the fMt material by gravity (Pereira et al., 2018). This allowed us to control and check that the transferred material has reached cecum.

Table 3 Factors involved in the development, nomenclature and effectiveness of fMt

Nomenclature	
First usage of fMt	the birth of fMTs: date back to 4th century China (denoted as "yellow soup")
	first moden fMt (Eiseman et al., 1958)
Heterologue-fMt 	conveying colonic ingredient rich in bacteria from a "donor" exhibiting no disease condition (suggested "healthy" microbiota), into a case with illness whose microbiota is "unhealthy" and probably contributing through inflammation (Arora et al., 2024)
Autologue-fMt 	usage and storage of an animal' fecal material during a healthy state (or to the present authors' knowledge following recovery period after infection/ disease state) for later conveying in an attempt to reinstitute intestinal microbial echology after disruption (Basson et al., 2020)
fMt response indicators 	– intrinsic factors (Diet type, environmental echology, genetic) (Basson et al., 2016) – indicator species through the recipient microbiome or recipient strain microechological diversity (Schmidt et al., 2022) – donor-related factors (age, lifestyle, drugs etc.) (Bibbò et al., 2020) – health status of donor (specifically microbiota) – pre-fMt case conditions – fMt administration route (Cammarota et al., 2017, 2019; Haifer et al., 2020; Lopetuso et al., 2023; Tian et al., 2022; Zhang et al., 2021)

3.7 Proposed Mechanism of Action for fMt

As aforementioned above on table table 3, fMt covered converying colonic environment rich in bacteria from a "donor" (with no evidence of detectable disease, presumed/suggested as exhbiting "healthy" microbiota), into a diseased harbouring "unhealthy" microbiota (Arora et al., 2024; Basson et al., 2020; Eiseman et al., 1958). In the latter process the purpose, in general, is to substitute unhealthy microbiota and to switch it to a healthy intestinal community. This could have helped the intestinal environment for diminishing inflammation and restoration of homeostasis. Given proposed mechanism of action for fMt:

a) direct/indirect efficacy through host immune system and gut microbiota;
b) maintanence of epithelieal integrity and diminishing intestinal permeability through elevated short chain fatty acids exhibition (Mocanu et al., 2021; Paramsothy et al., 2019);
c) restoration of immune battling (Shen et al., 2018),
d) quickly providing healthy saprophytic organisms in to the inflammatory location;
e) correction of dysbiosis (Arora et al., 2024) might be valid explanations.

All aforementioned supportive mechanisms should have helped clinical recovery that we observed at the present study. Overall efficacy were deemed available were detected as 76% (treatment success rate obtained). Someone might probably ask what is the reference for recovery. As shown on table 2, several different system diseases were enrolled, unpossible to discuss in a paper, recovert were referred to switching from disease status to health conditions along with dissappearence of illness conditions.

Interestingly, apart from or distinctly on the other side to the vast majority of studies reporting heterologous fMt, different researches were performed by use of autologous fMt, which is not well known on veterinary field, at least to the present authors knowledge. In this technique assembling feces from diseased case during therapeutical intervention, autologous fMT might be efficacous through 2 major routes. Firstly, microbiome belonging to diseased one could substitute from an "inflammatory" (dysbiotic) condition to an ''anti-inflammatory" (healthy) session. On the other hand microbiome of otherwise healthy one might switch from an ''anti-inflammatory" (healthy) session to those of ''inflammatory" condition for dysbiosis, in which, fMt could thus subsequently out-turn with negligible clinical respond (Basson et al., 2020). In the present study heterologus fMt applied in two different routes, could have helped switching from inflammatory state to healthy anti-inflammatory conditions, as was detected by overall efficacy. However we did not report – conventional methodology for

detecting pro-inflammatory cytokines nor inflammatory biomarkers (due to budget deprivation), whereas our next study would thus be aimed to comperatively investigate this subject. Moreover we decided to compare autologus fMt with heterologue fMt in a longitudinal study for the very nex future.

Regarding neurology field another study aimed to establish the probable positive efficacy of fMt on behavioral comorbid disturbances in a canine epilepsy with drug resistance. In that study fMt application were deemed available for 3 occasions, 2 weeks apart. Following fMt, cases exhibited showed improvement in attention deficit hyperactivity disorder – like behavior along with other relevant signs. In that study behavioral comorbidities were diminished via fMt. The authors concluded that fMt has the ability for treating behavioral comorbidities and modifying life quality in dogs with epilepsy (Watanangura et al., 2024). Selected researcher group of the present study previously reported the efficacy of fMt in ataxic cats (Ural et al., 2019). The gut microbiota-gut-brain axis achieved functional interactions between the gut and brain through many pathways, such as the immune pathway (Mayer et al., 2022), which was closely related to gut microbiota (Yu et al., 2022). The alterations of gut microbiota stimulated peripheral immune cells and regulated neuroinflammation in the brain (Wang et al., 2023). In the present study speficically to those of neurological cases, clinical recovery might be linked to this issue.

The 'gut microbiota-gut-brain axis' earned popularity and functional interplay among intestinal environment and brain through several pathways, (i.e. immunological route (Mayer et al., 2022)), to those of which exhibited link with intestinal microbiota (Yu et al., 2022). Even if changes in intestinal microbiota invigorated peripheric immune cells and influenced brain neuroinflammation (Wang et al., 2023). To those of human with rheumatoid arthritis receiving fMt exhibited a T-cell increase within the spleen, prone depression-like behaviors among mice (Yu et al., 2022). Probably neurological cases were giving respond in this study, might be briefly expalined with this subject. Triage changes obtained at this present study also denominated and supported the efficacy of fMt, at least cases herein involved.

4 Conclusions

In the present article, which took long time for performing nearly a moderately scaled meta-analysis, overall cure rates were deemed available were fascinating for withdrawal of several different system involvement. Field veterinarians probably in a hurry up, not possible to detect precise diagnosis because of lacking instruments, should be able to perform fMt with satisfactory results herein aforementioned above in detail. This treatment modality should be performed with experienced skills and instruments.

Author Contributions

Kerem Ural conceived and designed the study. Hasan Erdoğan, Songül Erdoğan, and Kerem Ural performed the data collection and statistical analyses. Hasan Erdoğan and Songül Erdoğan conducted the literature review and contributed to manuscript drafting. Kerem Ural, Hasan Erdoğan, and Songül Erdoğan contributed to the interpretation of the results. Kerem Ural took the lead in writing the manuscript. All authors provided critical feedback and contributed to refining the research, analysis, and manuscript.

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