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Equine

Survey on Faecal Microbiota Transplantation and Probiotic Use in Equine Practice in France and Belgium

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ABSTRACT

Background: Faecal microbiota transplantation (FMT) and probiotics are used in equine practice. Understanding veterinarians' perceptions and practices is crucial for effective implementation.

Objective: (1) Evaluate the prevalence, usage patterns and perceived effectiveness of probiotics and FMT among equine veterinarians in France and Belgium. (2) Assess their knowledge, practices and influencing factors across demographics and settings. (3) Explore links between FMT protocols and treatment satisfaction.

Study Design: Cross-sectional survey.

Methods: An online survey collected demographic data and responses on the use of probiotics and FMT. Analyses included descriptive statistics, chi-square tests and logistic regression models.

Results: Ninety-six equine veterinarians participated, practicing in Belgium (52.1%), France (39.6%) or both (8.3%). Probiotic use was reported by 82.1%, more frequent in field than clinical practice (odds ratio [OR] = 3.61, 95% CI [1.09, 12.02], $p = 0.036$) and in France than Belgium (OR = 5.08, 95% CI [1.44, 17.94], $p = 0.012$). Probiotics were used for chronic diarrhoea (88.0%), acute diarrhoea (67.6%) and inflammatory bowel diseases (45.9%). Most veterinarians (83.3%) defined probiotics well, but 16.7% misidentified non-probiotic products. FMT was used by 76.0%, mainly occasionally and therapeutically, more in clinical than field practice (OR = 4.79, 95% CI [1.03, 22.27], $p = 0.046$). In theory, 58.3% prioritized infection-free donors, but only 22.5% tested donors before FMT, mostly using coprology (93.8%). Those who tested donors reported higher perceived efficacy ($p = 0.0029$).

Main Limitations: Potential selection bias, as participation was voluntary. Generalizability might be limited by focus on France and Belgium. Sample size, while informative, should be expanded.

Conclusion: Probiotics and FMT were commonly used therapeutically by equine veterinarians in France and Belgium. Although probiotic use was widespread, some misunderstandings remained. FMT protocols varied, with donor faeces often untested. Treatment satisfaction was generally positive but estimated success rates varied. Standardized FMT protocols are needed to improve outcomes and consistency.

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1 | Introduction

The gastrointestinal (GI) tract harbours a complex and diverse microbiota, including bacteria, fungi and viruses, which play a fundamental role in maintaining digestive and overall health (Kamada et al. 2013; Van Den Abbeele et al. 2011). In horses, disruptions to this microbial balance, known as dysbiosis, have been associated with factors such as antimicrobial use, sudden change of diet, transportation, hospitalization, fasting and both GI and non-GI diseases in horses (Costa et al. 2012, 2015; Fernandes et al. 2014; Loublier et al. 2025; Salem et al. 2019; Schoster et al. 2017; Steelman et al. 2012; Theelen et al. 2021; Weese et al. 2015). Given its crucial role, modulation of the equine GI microbiota has garnered interest as a potential prophylactic and therapeutic strategy (Mullen et al. 2018).

Probiotics, defined as live microorganisms that confer health benefits when administered in adequate amounts, have been widely studied in human medicine for conditions such as antibiotic-associated diarrhoea, depressive symptoms (at least two weeks of anhedonia, apathy, depressed mood, and psychomotor slowing) and colorectal cancer (Hill et al. 2014). However, their efficacy in equine medicine remains uncertain and appears to depend on factors such as the specific probiotic strain, dosage and host response (Desrochers et al. 2005; Schoster et al. 2014; Weese and Rousseau 2005).

Faecal microbiota transplantation (FMT), another microbiota-targeted therapy, aims to restore microbial balance by transferring faecal material from a healthy donor to a recipient. Although FMT has been well-documented in human medicine, particularly for the treatment of recurrent *Clostridioides difficile* infections, its use in equine medicine remains less established (Baunwall et al. 2021; Cammarota et al. 2019; Quraishi et al. 2017). Current literature presents conflicting results regarding its prophylactic and therapeutic benefits, with variations in preparation methods, donor selection and administration protocols potentially influencing treatment outcomes (Costa et al. 2021; Feary and Hassel 2006; Kinoshita et al. 2022; Laustsen et al. 2021; McKinney et al. 2020, 2021; Mullen et al. 2018; Pietro et al. 2023). Unlike human medicine, where consensus guidelines exist for FMT, equine FMT lacks standardized, evidence-based assessments (Cammarota et al. 2019). To the author's knowledge, only few studies exist regarding FMT quality assessment, and guidelines based only on personal experiences have been suggested (Loublier et al. 2023; McKinney et al. 2020; Mullen et al. 2018; Pietro et al. 2023).

Despite the growing interest in probiotics and FMT in equine medicine, comprehensive data on their usage, prevalence, application patterns and perceived effectiveness among veterinarians remain scarce. Such information is critical for developing evidence-based guidelines for microbiota-targeted therapies in horses.

This study aimed to evaluate the use, prevalence and perceived effectiveness of probiotics and FMT among equine veterinarians in France and Belgium. It also examined veterinarians' knowledge, clinical practices and the factors influencing the adoption of these therapies across various demographics and practice settings. Emphasis was placed on FMT protocols to assess their role in treatment outcomes. We hypothesized that the adoption of probiotic and FMT therapies is influenced by factors such as clinical experience, access to specialized training and type of practice. We also anticipated that both therapies would be widely used, but with differing levels of perceived effectiveness, and that specific FMT protocols could be associated with improved treatment outcomes.

2 | Materials and Methods

2.1 | Survey Conception

An online questionnaire in French was developed using Google Forms (Supporting Information 1). The survey comprised 35 questions, including multiple-choice, single-choice and short open-ended questions. Open-ended responses were manually analyzed by a single observer (CL) and categorized based on synonyms or conceptual equivalence to guarantee comprehensive inclusion of all responses. The survey was designed with the objective to assess veterinarians' understanding and application of probiotic and FMT in their equine medicine practice, as well as their perception on these treatments' effectiveness. For that purpose, the questionnaire was structured into the two following sections: (1) demographic information (gender, age, duration of equine medicine practice, country of practice, work structure, level of specialization) and (2) probiotic and FMT use (veterinarians' knowledge, usage patterns, selection criteria for FMT donors and recipients, FMT procedure practices and opinions on FMT efficacy).

2.2 | Survey Distribution

The questionnaire targeted veterinarians practicing equine medicine in France and Belgium. The survey was distributed through several channels. It was featured in the November 2022 newsletter of the AVEF (French Equine Veterinary Association), emailed to veterinarians registered in the French and French-speaking Belgian veterinary orders in December 2022 and published twice on the French veterinary online platform Vetofocus (June and November 2022). Between June 2022 and December 2022, it was also broadcast on the social network Facebook in a dedicated group of equine veterinarians and on SurveyCircle, a questionnaire platform. The questionnaire was available for responses until January 2023.

2.3 | Statistical Analysis

Descriptive statistics were presented as frequency tables. Logistic (ordinal) regression models were employed to analyse the use of probiotic and FMT as well as to evaluate knowledge levels. Odds ratios (ORs) with 95% confidence intervals were reported. Firth's correction was applied where necessary to address convergence issues. Multivariate models were also constructed. The association between FMT efficacy and various parameters was assessed using chi-square tests. Statistical significance was set at $p < 0.05$. All analyses were performed using SAS version 9.4.

TABLE 1 | Table describing the demographic characteristics of responding veterinarians.

Variables	*n*	%
Gender ($n = 80$)		
Female	53	66.3
Male	27	33.7
Age group ($n = 70$)		
23–35 years	30	42.9
35–55 years	23	32.9
>55 years	17	24.3
Veterinary practice experience ($n = 96$)		
<10 years	55	57.3
>10 years	41	42.7
Practice location ($n = 96$)		
Belgium	50	52.1
France	38	39.6
Belgium, France	8	8.3
Specialization ($n = 96$)		
No specialization	90	93.8
Specialized	6	6.3
College type (among specialized, $n = 6$)		
Internal medicine (ECEIM/ACVIM)[a]	5	83.3
Surgery (ECVS)	1	16.7
Practice type ($n = 93$)		
Field	68	73.1
Clinic	18	19.4
Both field and clinic	7	7.5

Abbreviations: ACVIM, American College of Veterinary Internal Medicine; ECEIM, European College of Equine Internal Medicine; ECVS, European College of Veterinary Surgeons.
[a]ECEIM: $n = 4$; ACVIM: $n = 1$ combined with ECEIM.

3 | Results

3.1 | Description of the Responding Veterinarians

We received 102 answers to the questionnaire but 6 were excluded because the veterinarians were not practicing in Belgium or France. Therefore, the questionnaire responses from 96 equine veterinarians were used in the study (Table 1). Most of the responders were women (66.3% women, 33.7% men) and were less than 35 years old (42.9%), followed by those between 35 and 55 years old (32.9%) and those older than 55 years old (24.3%). Approximately half of the respondents (57.3%) had less than 10 years of experience in veterinary practice. The respondents were predominantly practicing in Belgium (52.1% in Belgium), whereas 39.6% were practicing in France, and 8.3% in both countries. Most respondents worked in the field (73.1%), whereas 19.4% worked in clinics, and 7.5% worked in both types of practices. Only 6.3% were board-certified from the European College of Equine Internal Medicine (ECEIM) or of Veterinary Surgery (ECVS), or from the American College of Veterinary Internal Medicine (ACVIM). The number of responses to each survey question may differ slightly, as participation in individual items was not mandatory.

3.2 | Use and Knowledge of Probiotic

Among the 96 responding veterinarians, 82.1% reported using probiotics (Table 2). Most of them were female (69.4%) and under 35 years old (42.3%). The majority had less than 10 years of veterinary practice (60.3%). Participants were distributed equally between France and Belgium. A large majority were not specialized (93.6%) and primarily worked in field practice (76.6%) (Supporting Information 2). Univariate analysis indicated higher probiotic usage rates among those working in the field than in clinic (OR = 3.61, 95% CI [1.09, 12.02], $p = 0.036$) and in France than in Belgium (OR = 5.08, 95% CI [1.44, 17.94], $p = 0.012$). Multivariate models confirmed their dominant use in France (OR = 10.41, 95% CI [2.03, 53.48], $p = 0.0050$) and an increased use in field only (OR = 4.37, 95% CI [1.20, 15.87], $p = 0.026$). Among the respondents, 97.4% used probiotic for therapeutic purposes, whereas 66.2% used them for prophylaxis, and 63.6% for both purposes. For therapeutic purposes (multiple choices possible), most veterinarians (88.0%) used probiotics to treat chronic diarrhoea, 67.6% for acute diarrhoea, 45.9% for inflammatory bowel diseases (IBDs) and a small number (5.4%) for other conditions such as behavioural abnormalities, laminitis, dermatological diseases and weight loss. Among veterinarians using probiotics for prophylactic purposes, 82.3% combined them with antibiotics, 49.0% with dietary changes and one veterinarian combined them with transport. Veterinarians were asked to name the probiotics they used in practice to indirectly evaluate their understanding of the definition of a probiotic (Table 3). Sixty-six veterinarians answered this question. The main probiotics quoted were primarily Bo Yeas Act Ultra (34.8%), Florequin (34.8%), Flore process (31.8%). The others were used by less than 15% of veterinarians. However, among the sixty-six respondents, 11 (16.7%) wrongly named at least one product as probiotics in their list, as they confused them with prebiotic, postbiotic or phytotherapeutic products. Overall, 55 (83.3%) veterinarians quoted true probiotics (Table 2). Knowledge of probiotic names was significantly better in veterinarians practicing in France (OR = 7.11, 95% CI [1.56, 32.49], $p = 0.011$) than those practicing in Belgium when tested with univariate analysis, but not when tested using a multivariate model. Veterinarians aged 35–55 years old had better knowledge than those aged more than 55 years old (OR = 55.80, 95% CI [1.95, 1597], $p = 0.040$) when tested using a univariate as well as a multivariate model.

3.3 | Use and Knowledge of FMT

Among the respondent veterinarians, 76.0% declared to have used FMT at least once (Supporting Information 3). The users were more frequently those practicing in France than in Belgium (OR = 4.61, 95% CI [1.54, 13.76], $p = 0.0061$), and with less than 10 years of experience as compared with those with more years of experience (OR = 2.65, 95% CI [1.01, 6.94], $p = 0.047$) and practicing in a clinic rather than in the field only (OR = 4.79, 95% CI [1.03, 22.27], $p = 0.046$). Among the FMT users, only one (1.4%) used it for prophylactic purposes when using antibiotics, whereas all (100%) used it for therapeutic purposes. None used it exclu-

TABLE 2 | Table describing the probiotic usage patterns among responding veterinarians.

Variables	n	%
Probiotic use ($n = 95$)		
No	17	17.9
Yes	78	82.1
Purpose of probiotics use ($n = 77$)		
Prophylaxis only	2	2.6
Therapy only	26	33.8
Prophylaxis + Therapy	49	63.6
Use for prophylaxis ($n = 77$)		
No	26	33.8
Yes	51	66.2
Prophylactic context ($n = 51$)		
Antibiotic	26	51.0
Dietary changes	9	17.6
Antibiotic and dietary changes	15	29.4
Antibiotic, diet and transport	1	2.0
Use for therapy ($n = 77$)		
No	2	2.6
Yes	75	97.4
Therapeutic applications		
For chronic diarrhoea ($n = 75$)		
No	9	12.0
Yes	66	88.0
For acute diarrhoea ($n = 74$)		
No	24	32.4
Yes	50	67.6
For IBD ($n = 74$)		
No	40	54.1
Yes	34	45.9
For other conditions ($n = 74$)		
No	70	94.6
Yes	4	5.4
- Behaviour/dermatology	1	1.4
- Laminitis	1	1.4
- Weight loss	2	2.7
Knowledge assessment ($n = 66$)		
Misclassified at least one product	11	16.7
Correctly identified probiotics	55	83.3

Abbreviation: IBD, inflammatory bowel disease.

sively for prophylaxis. FMT was used to treat (multiple choices possible) chronic diarrhoea (87.7%), acute diarrhoea (56.2%), IBD (24.7%), and other causes such as weight loss or intoxication (4.1%). Among the veterinarians who had never used FMT (24%), the main reason reported was a perceived lack of need (52.2%), followed by a lack of evidence-based information on its use (30.4%), difficulties in communicating with owners (13.0%), the time-consuming aspect of the procedure (8.7%) or challenges in finding a suitable donor (8.7%). Of the 73 veterinarians practicing FMT, 67.1% used it occasionally (one patient every 1 or 2 years), 27.4% moderately frequently (one patient every 3 months), and 5.5% frequently (several patients per month) (Figure 1).

The question on self-assessment of knowledge concerning FMT showed that 64.2% estimated to have basic knowledge, 22.1% had in-depth knowledge, and 13.7% had only heard about it. Their knowledge in the field came primarily from bibliography (59.6%), followed by conferences (53.2%), veterinary studies (43.6%) and, finally, work-related discussions (37.2%). The self-evaluation of FMT knowledge was higher in veterinarians working in France than in Belgium (OR = 2.90, 95% CI [1.21, 6.97], $p = 0.017$ based on univariate and multivariate analysis). The self-evaluation of FMT knowledge was not statistically associated with the specialization status, the gender or the type of practice. However, trends were observed (specialization OR = 4.31, 95% CI [0.83, 22.47], $p = 0.083$, women gender OR = 2.56, 95% CI [0.95, 6.91], $p = 0.064$ and working in clinical practice OR = 2.58, 95% CI [1.00, 6.70], $p = 0.051$). A statistically significant association was observed between the level of knowledge about FMT and the frequency of its use ($p < 0.001$). Respondents with in-depth knowledge were associated with moderate use (12/21, 57.1%), whereas those with basic knowledge were associated with occasional (41/61, 67.2%) and moderate use (8/61, 13.1%). Notably, individuals who had just heard of FMT reported no use at all (100%) (Table 4) ($p < 0.001$).

When veterinarians were asked about the theoretical criteria for selecting the FMT donors, the primary concern was ensuring the absence of infections, verified through negative coprology and screenings for equine infectious anaemia, *Salmonella* spp., *Clostridium* spp. (*C. difficile* and *C. perfringens*) and Coronavirus, a criterion cited by 58.3% of respondents. Additionally, 51.4% considered selecting donors from the same location as the recipient, whereas 33.3% prioritized donors that had not undergone treatments in the past 6 months or more. Other factors included a forage-based diet (27.8%) and using the mother as the donor for foals (15.3%). Notably, 11.1% of veterinarians reported having no specific criteria for donor selection. Among veterinarians using FMT, there was no significant association between their self-reported level of FMT knowledge and their theoretical answers regarding the performance of donor testing ($p = 0.12$).

3.4 | FMT Procedure in Practice (Table 5)

Key methodological aspects of FMT application among surveyed veterinarians are summarized in Table 5. Approximately one-fifth (16/72, 22.5%) of respondents conducted donor screening, most commonly utilizing coprology, with fewer performing blood, bacterial, or viral tests. FMT was administered across all age categories, with a notable prevalence in adult horses aged 5–20 years. Rectal fecal collection and manual mixing with warm water were the predominant approaches, and filtration was typically performed using fabric or sieves. Administration was almost exclusively via nasogastric intubation, most often delivered once daily over three days. Fees for the procedure most ranged from 25 up to 100 euros. Use of additives such as bicarbonate, or pre-infusion storage of fecal material, was rare. Importantly, donor

TABLE 3 | Table describing the list of reported probiotic products among responding veterinarians: key components and classification validation.

Commercial name	Key components	True probiotics?	Number of users (*n*, %)
Bentovet plus	Glycerine, dextrose, beet molasses, yeasts products, various salts and organic acids. No live microorganisms	**No**	1 (1.5)
Bo Yeas Act Ultra	*Saccharomyces cerevisiae* (MUCL 52946), *Saccharomyces cerevisiae* (NCYC Sc 47) 1.056×10^{12} CFU/kg, *Saccharomyces cerevisiae* (MUCL 39885) 3×10^{9} CFU/kg)	**Yes**	23 (34.8)
De Groene Os Ultimaflor	Inactivated yeast, *Saccharomyces cerevisiae* 3×10^{9} CFU/g	**Yes**	1 (1.5)
Dia gest Phytovet	Carob flour, dextrose, sucrose, vitamin C. No live microorganisms	**No**	2 (3)
EDHYA form	Barley germination. *Lactobacillus buchneri* and *Pediococcus acidilactici* 3×10^{8}/g	**Yes**	5 (7.6)
Equi process	Products resulting from the germination and lactic fermentation of barley grains. Specific FAP process (assimilation factor process). No live microorganisms	**No**	2 (3)
Flore équilibre	Lactic acid bacteria (lactobacilli, bifidobacteria) 40×10^{9} CFU/portion	**Yes**	5 (7.6)
Flore process	Barley germination and lactic fermentation. No live microorganisms	**No**	21 (31.8)
Flore Reverdy	Live yeasts (*Saccharomyces cerevisiae* strain Sc 47) 2.0×10^{9} CFU, Bacterial assimilation factors from lactic fermentation, Fermented organic wholemeal bread	**Yes**	2 (3)
Florequin	Selected yeast products of *Saccharomyces cerevisiae* (2.5×10^{12} CFU/portion) and *Cyberlindnera jadinii* (Yang)	**Yes**	23 (34.8)
Gastrophytum	Licorice, green clay, aloe vera. Herbal ingredients only	**No**	1 (1.5)
Gutaphytum	Turmeric, star anise, feverfew, comfrey, lemon bal. Herbal ingredients only	**No**	1 (1.5)
Levacarb liquid	Activated charcoal, bentonite, electrolytes. No live microorganisms	**No**	2 (3)
Levacarb powder	Yeast (name and quantity not described), activated charcoal, bentonite	**Yes**	1 (1.5)
Multiphytum	Thyme, rosehip. Herbal ingredients only	**No**	1 (1.5)
Natural Digest Natural Innov	Inactivated whole yeast (name and quantity not described), soluble fermentation solids from hydrolysed yeast, lithothamnium, extruded soybean, vegetable fat	**Yes**	1 (1.5)
Norm Prozorb	*Enterococcus faecium* 1×10^{8} CFU, montmorillonite, charcoal, various electrolytes	**Yes**	2 (3)
Postact process	Barley germination and lactic fermentation. Bentonite; no live microorganisms	**No**	8 (12.1)
Pro B flora Unika	*Saccharomyces cerevisiae* NCYCSC47 8×10^{8} CFU Yeast (brewer's yeast); various prebiotics (chicory inulin; fructooligosaccharides)	**Yes**	2 (3)
Proferm horsevitality	100% spelt bran fermented with effective microorganisms (names and quantity not described)	**Yes**	5 (7.6)
Profix	*Saccharomyces cerevisiae* 4b 1702 (CNCM I-4407) 1×10^{12} CFU/kg, fructo-oligosaccharides	**Yes**	1 (1.5)
Promodulate	*Saccharomyces cerevisiae* 2.2×10^{11} CFU, fructooligosaccharide 97.4%, electrolytes	**Yes**	2 (3)
Promodulate Equin	*Saccharomyces cerevisiae* 2.2×10^{11} CFU, fructooligosaccharide (FOS) 97.4%, sodium chloride 0.3%, potassium chloride 0.1%	**Yes**	1 (1.5)
Pro'Stimul	*Saccharomyces cerevisiae* CNCM I-4407: 200×10^{10} CFU/kg, yeast cell walls	**Yes**	1 (1.5)
Vediflore	Lactic ferments from cereals, inactivated yeast strain *Saccharomyces cerevisiae* (quantity not described), sorbitol and hydrogenated triglycerides of plant origin	**Yes**	3 (4.5)

FMT SURVEY RESULTS (n=96)					
USED FMT 76.0% (n=73)				NEVER USED FMT 24.0% (n=23)	
FREQUENCY		EXPERIENCE		REASONS FOR NOT USING	
Occasional	67.1%	< 10 years	74.0%	No need	52.2%
Moderate	27.4%	> 10 years	26.0%	Lack of evidence	30.4%
Frequent	5.5%			Communication barriers	13.0%
				Time consuming	8.7%
				Donor finding issues	8.7%

CLINICAL APPLICATIONS (n=73)			
PURPOSE OF USE		THERAPEUTIC APPLICATIONS	
Therapy only	98.6%	- Chronic diarrhea	87.7%
Both uses	1.4%	- Acute diarrhea	56.2%
Prophylaxis only	0.0%	- IBD	24.7%
		- Other (weight loss, intoxication)	4.1%
PROPHYLAXIS USE			
Yes (antibiotics)	1.4%		
No	98.6%		

FIGURE 1 | Nested box describing the responses of veterinarians concerning faecal microbiota transplantation (FMT).

TABLE 4 | Table describing the frequency of faecal microbiota transplantation (FMT) use according to self-reported knowledge level.

FMT knowledge	FMT frequency use				Total
	No	Occasional	Moderate	Frequently	
Just heard	13	0	0	0	13 (13.7)
Basic	9	41	8	3	61 (64.2)
In-depth	0	8	12	1	21 (22.1)
Total (*n*/%)	22 (23.2)	49 (51.6)	20 (21.1)	4 (4.2)	95 (100)

testing was significantly associated with greater perceived clinical efficacy ($p = 0.0029$). Selecting donors with a forage diet or not filtering the FMT before administration tended to be more commonly used in the positive perception group, but results were not significantly different ($p = 0.061$ and 0.064, respectively) (Supporting information 4).

4 | Discussion

This study provided valuable insights into the use of probiotics and FMT among equine veterinarians working in France and Belgium. The response rate from veterinarians working in Belgium represented around 15% of the French-speaking Belgian equine veterinary population, ensuring robust representation (330 equine veterinarians recorded in the French-speaking part of Belgium in 2022) (Belgian Order, personal communication, 2022). In contrast, the response rate of the equine veterinarians working in France was lower, accounting for approximately 1% of the national equine veterinary population (3314 equine veterinarians recorded in France in 2022) (French Order, personal communication, 2022). The gender distribution of respondents reflected the demographic composition of the equine veterinary profession in France, where women account for 58% of equine veterinarians (French Order, personal communication, 2022) and 30% in Belgium (Belgian Order, personal communication, 2022). Most respondents had not completed a specialization; among those board-certified, ECEIM certification was most common, reflecting the medical focus of FMT use.

TABLE 5 | Table describing veterinarians' responses regarding the faecal microbiota transplantation (FMT) performed in their practice.

Variable	N	Number (%)
Donor tests	71	
No		55 (77.5)
Yes		16 (22.5)
Donor tests type	16	
Coprology		6 (37.5)
Bacterial testing		1 (6.3)
Coprology, bacterial testing		1 (6.3)
Blood analysis, coprology		6 (37.5)
Blood analysis, coprology, bacterial testing, viral testing		1 (6.3)
Coprology, bacterial testing, viral testing		1 (6.3)
Donor faecal collection	72	
Rectal collection		41 (56.9)
Warm feces from the ground		18 (25.0)
Warm feces from the ground, rectal collection		13 (18.1)
Donor faecal quantity	70	
A Handful		24 (34.3)
Half a pile		13 (18.6)
A Pile		24 (34.3)
Several piles		5 (7.1)
Variable quantity		4 (5.7)
Diluent type	71	
Water		63 (88.7)
Water and salt		8 (11.3)
Diluent temperature	71	
Cold (<20°C)		5 (7.0)
Warm (20–37°C)		58 (81.7)
Hot temperature (>37°C)		2 (2.8)
Any temperature		6 (8.5)
Mixing type	71	
No mix		1 (1.4)
Manual (hand, spoon, hip)		60 (84.5)
Mechanical (blender)		10 (14.1)
Filtration use	71	
No		14 (19.7)
Yes		57 (80.3)
Filtration type	57	
Fabric		32 (56.1)
Sieve		18 (31.6)
Fabric or sieve		7 (12.3)
After preparation	71	
Give it straight		67 (94.4)
Give it straight or store (4°C)		3 (4.2)
Give it straight or store (−18°C)		1 (1.4)

(Continues)

TABLE 5 | (Continued)

Variable	N	Number (%)
Bicarbonate additive	71	
No		66 (93.0)
Yes		5 (7.0)
Bicarbonate quantity (mg)	3	
60		1 (33.3)
4000		1 (33.3)
60,000		1 (33.3)
Recipient age horse (multiple responses allowed)	72	
<1 year		5 (6.9)
1–5 years		14 (19.4)
5–20 years		21 (29.2)
>20 years		3 (4.2)
Not based on age		42 (58.3)
Recipient preparation	71	
No		45 (63.4)
Yes		26 (36.6)
Recipient preparation-type	25	
Stop AB		2 (8.0%)
Omeprazole		14 (56.0%)
Omeprazole, stop AB		7 (28.0%)
Fasting		2 (8.0%)
FMT transfer type	71	
Nasogastric		67 (94.4)
Nasogastric or oral		3 (4.2)
Nasogastric or rectally		1 (1.4)
FMT daily frequency	71	
1×/day		62 (87.3)
2×/day		5 (7.0)
3×/day		4 (5.6)
FMT duration	71	
For less 3 days		25 (35.2)
For 3 days		26 (36.6)
Until symptoms end		20 (28.2)
FMT price (euros)	72	
Free		4 (5.6)
<25		2 (2.8)
25–50		48 (66.7)
50–100		18 (25.0)
FMT prophylaxis success satisfaction	1	
60%–70% prophylaxis		1 (100.0)
FMT therapy success satisfaction	72	
Little or not effective (<40%)		3 (4.2)
Random (50%–60%)		24 (33.3)
Effective (>60%)		45 (62.5)

Probiotics were more widely used than FMT (82.1% vs. 76.0%), primarily for therapeutic purposes (97.4% for therapy vs. 66.2% for prophylaxis), especially in cases of chronic and acute diarrhoea, and to a lesser extent, IBD. Notably, a few veterinarians reported using probiotics for non-GI conditions such as behavioural abnormalities, laminitis, dermatological diseases and weight loss, likely extrapolating from human medicine where 'psychobiotic therapies' have shown promise to modulate the gut–brain axis (Ribeiro et al. 2022; Slykerman et al. 2017; Sun et al. 2022). Nevertheless, there is some evidence that the intestinal microbiota composition might play a role in equine behaviour (Destrez et al. 2015; Mach et al. 2020), but microbiota manipulation used to modulate their behaviour remains to be demonstrated.

The main use of probiotics for GI diseases aligns with published literature, though results remain controversial (Shaw and Stämpfli 2018). For example, *Saccharomyces boulardii* has been shown to reduce diarrhoea duration in some studies (Desrochers et al. 2005), but not in others (Boyle 2021). Similarly, administration of *Lactobacillus* spp. and *Bifidobacterium animalis* lactis had minimal impact on clostridial shedding or faecal microbiota composition in a study performed in foals (Schoster et al. 2014). Studies on postoperative colic patients and hospitalized horses have yielded controversial results regarding the impact of probiotics on *Salmonella* shedding and diarrhoea incidence (Parraga et al. 1997; Ward et al. 2004). Although some evidence supports their prophylactic use (Tanabe et al. 2014), other studies found no significant benefit (John et al. 2015). Moreover, an accurate assessment of the literature on probiotics is hindered by publication bias, which may lead to an overestimation of their efficacy (Weese 2025). A recent study evaluating probiotic interventions for GI diseases in dogs and cats identified significant publication bias: abstracts reporting positive clinical outcomes were substantially more likely to be published (83% of published abstracts) compared to those reporting no beneficial effects (67% of unpublished abstracts). Such bias complicates the critical appraisal of the available evidence and poses challenges for the development of evidence-based clinical guidelines. Research on non-GI indications is limited, with only isolated reports of benefits in weight gain and diarrhoea reduction in foals (Yuyama 2005).

In our study, most respondents using probiotics worked in field settings (OR = 3.61, 95% CI [1.09, 12.02], $p = 0.036$), whereas those using FMT were more frequently working in clinical settings (OR = 4.79, 95% CI [1.03, 22.27], $p = 0.046$), likely due to the easier administration of probiotics than FMT. Veterinarians working in France were more likely to use both probiotics (OR = 10.41, 95% CI [2.03, 53.48], $p = 0.0050$) and FMT (OR = 4.61, 95% CI [1.54, 13.76], $p = 0.0061$) than the veterinarians working in Belgium, though the reason for this difference remains unclear.

Many responding veterinarians demonstrated confusion regarding probiotic products, with 16.7% misidentifying non-probiotic products as probiotics. Knowledge was significantly higher among veterinarians working in France (OR = 7.11, 95% CI [1.56, 32.49], $p = 0.011$) than in Belgium, with univariate analysis. This highlights the need for clearer definitions, improved education and more accurate product labelling. Multiple studies have documented inconsistencies in the labelling and content of commercial probiotic products, including omission of key information, mislabelling and inclusion of non-probiotic or potentially pathogenic microorganisms (Berreta et al. 2021; Schoster et al. 2014). The clinical efficacy and safety of probiotics in horses remain insufficiently supported by robust data (Schoster et al. 2014). Some strains, such as *Lactobacillus pentosus*, have been associated with adverse effects (Weese and Rousseau 2005), and others may carry transferable antibiotic resistance genes (Weese 2002). Although our survey did not specifically address adverse events, the literature underscores the need for more controlled studies to establish the safety and efficacy of those products.

Veterinarians of our study primarily gained knowledge on FMT from literature (59.6%), conferences (53.2%), veterinary studies (43.6%) and work-related discussions (37.2%). Improved knowledge was associated with increased FMT acceptability ($p < 0.001$). This observation has also been reported in human medicine, where individuals with knowledge of FMT demonstrated higher acceptability of undergoing the procedure (Benech et al. 2022).

FMT was used by 76.0% of respondents, typically on an occasional basis (one patient every 1 or 2 years), mainly for diarrhoea and, to a lesser extent, IBD. Barriers to FMT use included perceived lack of necessity (52.2%), limited evidence-based data (30.4%), communication challenges with owners (13.0%), time constraints (8.7%), and difficulty finding suitable donors (8.7%). All veterinarians used FMT therapeutically, with only one veterinarian reporting prophylactic use during antibiotic administration. The limited use of FMT for prophylaxis may be due to its more invasive and constraining nature compared to probiotics. The efficacy of FMT for prophylaxis remains unclear, with a recent study showing no significant benefit in preventing antibiotic-induced dysbiosis (Kinoshita et al. 2022). Moreover, the literature does not provide clear conclusions on FMT efficacy in diarrhoeic horses: Some studies failed to detect significant changes in the faecal microbiota after FMT, whereas others described trends toward increased alpha-diversity and compositional similarity to healthy horses (Costa et al. 2021; McKinney et al. 2020). However, these studies are limited by the small sample sizes, the failure to control the cause of diarrhoea in naturally occurring cases, and the lack of control groups (Boucher et al. 2024). FMT use was more common among veterinarians working in France, in clinical settings, and among those with less than 10 years of experience. Although FMT has been used 'for decades', the result of our study suggests a trend of increasing FMT use (Mullen et al. 2018).

Although subjective and not scientifically tested, perceptions of FMT efficacy for therapeutic use were generally positive in our study, with 62.5% of veterinarians considering it effective (giving a success rate of more than 60%). However, around one-third of the responders reported a random effectiveness (approximately 50% of success rate), and a few (3%) even reported a perception of low efficiency. In the literature, the efficacy of FMT in equine medicine is not conclusively established, with studies showing mixed outcomes (Costa et al. 2021; McKinney et al. 2020). In our study, when considering the criteria used for donors and receivers or the technique used to apply the FMT, the only variable significantly associated with an improved perception of efficiency by the veterinarian was pre-FMT donor testing ($p = 0.0029$), supporting the need for systematic donor screening. A forage-based donor diet showed a trend toward improved perception of efficiency ($p = 0.061$), though not statistically significant.

Although this association did not reach statistical significance, it remains biologically plausible as forage-based diets have been shown to have a positive impact on the equine intestinal microbiota by inducing a better stability of the microbiota and higher number of species compared to forage-concentrate diet (Dougal et al. 2014; Willing et al. 2009). The selection of equine donors warrants further investigation.

Similarly, filtration exhibited a borderline trend ($p = 0.064$), potentially indicating that avoiding filtration during FMT preparation may preserve key microbial components adhered to the fibre and improve clinical responses. However, these observations should be interpreted cautiously due to the limited sample size, the subjective nature of collected data and the lack of statistical significance. Other factors, such as age of the receiver, donor selection and preparation protocols, were not significantly associated with effectiveness perception of the FMT, underscoring the need for controlled prospective studies. Most veterinarians rated their self-evaluated knowledge of FMT as basic (64.2%), with only 22.1% reporting in-depth knowledge. Clearly, the provision of evidence-based proofs of efficacy and better information for veterinarians in this field could logically support wider use of this technique, which has been shown to be effective in the treatment of several diseases in human medicine (Baunwall et al. 2021; Cammarota et al. 2019; Ianiro et al. 2018; Quraishi et al. 2017).

Donor selection criteria varied among the responders in this study, with infection-free status, geographic proximity and absence of recent medical treatments being the most commonly considered. However, 11.1% of respondents indicated that they do not use any donor selection criteria, highlighting concerns regarding knowledge gaps and the lack of consensus. Even if there is no published consensus on it, several studies recommend comprehensive screening of the donors prior to FMT, including physical examination, clinical history, vaccination and deworming status and infectious disease testing (e.g., PCR panels for Coronavirus, *C. difficile* toxins, *C. perfringens* antigens, *Lawsonia intracellularis*, *Neorickettsia risticii* and *Salmonella* spp.) (Mullen et al. 2018). Geographical proximity between the donor and recipient, as well as a washout period and exclusion of disease within the previous 6–12 months, are also often advised (McKinney et al. 2020; Mullen et al. 2018; Tuniyazi et al. 2023). Both healthy geriatric and young-adult horses may serve as donors, with studies reporting the use of one to three donors, likely reflecting availability rather than an optimal number (McKinney et al. 2020; Tuniyazi et al. 2023). Despite clear recommendations in the literature for comprehensive pre-FMT donor screening, only 22.5% of veterinarians reported performing such tests, highlighting a significant gap in best practices that may compromise the safety, consistency and reliability of treatment outcomes. Prices charged varied between 25–50 euros for 66.7% of FMT users, but the questionnaire did not specifically ask respondents to distinguish between veterinarian fees and additional laboratory costs; thus, the reported prices may not reflect all expenses incurred by the client.

Most veterinarians in the present study used fresh faeces collected rectally, diluted with warm water, mixed manually and filtered before administration via nasogastric tube, consistent with published protocols (Costa et al. 2012; Mullen et al. 2018). Rectal collection of fresh faeces from the donor is the most commonly used collecting method, though other methods, such as collecting warm faeces from the ground, using a faecal collector or administering frozen aliquots, have also been described (Mullen et al. 2018; Tuniyazi et al. 2023). Administration of caecal contents obtained immediately after euthanasia of a healthy donor has also been reported but was not mentioned by any of the respondents, likely due to practical challenges (Feary and Hassel 2006; Mullen et al. 2018). Mixing fresh stool with lukewarm water is a standard step, but the faeces-to-water ratio varies widely in the literature (e.g., 1 kg in 4 L, 1 kg in 5 L, 1.6 kg in 3.2 L, 500 g in 1 L or 300 g in 1 L) (Costa et al. 2021; Kinoshita et al. 2022; Loublier et al. 2023; McKinney et al. 2020; Pietro et al. 2023). Such variations in preparation methods, diluent types and temperatures, mixing and filtration could impact the bacterial quality of the final sample, underscoring again the need for standardized FMT protocols (Loublier et al. 2023; Pietro et al. 2023). Interestingly, one veterinarian reported rectal administration of FMT. Although previously described, this route is discouraged in horses due to the long descending colon, which may impede transit of faecal material to the large colon and caecum (Brandt and Aroniadis 2013). In the present study, the volume of faecal material collected from donors varied among practitioners (from a handful to a full pile), whereas the literature typically describes quantities ranging from 0.5 to 2 kg (Tuniyazi et al. 2023). For reference, a single faecal pile from a 500 kg horse is estimated at 700 g to 1.8 kg, with total daily output ranging from 9 kg (stabled) to 23 kg (pasture-kept) (Boscan et al. 2006; Williams et al. 2015). Frequency and duration of FMT administration used by the veterinarians of the present study also widely varied, with most practitioners administering it once daily (87.3%) for up to 3 days (71.4%), consistent with published regimens that range from a single dose to once or twice daily for 3–5 days (Bell et al. 2024; Kinoshita et al. 2022; Laustsen et al. 2021; McKinney et al. 2020; Pietro et al. 2023). Most (58.3%) veterinarians did not restrict FMT to a specific recipient age, and literature supports its use in foals and geriatric horses (McKinney et al. 2020; Mullen et al. 2018). Some veterinarians did prepare the recipient horse before performing FMT (36.6%), and omeprazole use was frequent (84%), likely aiming to reduce gastric acidity and thereby improve bacterial viability (Mullen et al. 2018). This approach finds some parallel in human medicine, where the peri-interventional use of prokinetics and proton pump inhibitors (PPIs) has been reported for upper GI FMT delivery. However, consensus statement highlights that the beneficial effects of these medications remain unproven; moreover, due to their potential side effects and the capacity to alter gut microbiota, their use should be approached with caution (Cammarota et al. 2019). This underscores the need for further research and careful consideration of recipient preparation protocols in both veterinary and human FMT practice. The findings of our study highlight the considerable diversity in FMT practices in equine medicine and underscore that variations in preparation methods, diluent types and filtration could impact the quality and safety of the final product, which reinforces the urgent need for standardized, evidence-based protocols to ensure consistency and optimal clinical outcomes (Arantes et al. 2025; Loublier et al. 2023; Pietro et al. 2023).

The main limitations of this study are potential selection bias, as participation was voluntary and may have attracted veterinarians with a particular interest in probiotics and FMT, and limited generalizability due to the focus on France and Belgium and a low response rate from France. Although the sample size provides valuable insights, a larger cohort would strengthen future conclusions. The cross-sectional, self-reported design may not fully reflect actual clinical practices, and accurate data such as donor age, number, clinical data of each treated case, effects of the treatments on clinical signs, ancillary examination results or intestinal microbiota were not collected, which made a rigorous scientific evaluation of the FMT efficiency impossible. Despite these limitations, this study demonstrated that probiotics and FMT are widely used for GI disorders, even though supporting evidence remains limited and conflicting. Future research should prioritize large controlled prospective studies to clarify the benefits and risks of these interventions and to develop standardized guidelines, ultimately improving care and outcomes for equine patients.

5 | Conclusions

This study highlights widespread use of probiotics and FMT among equine veterinarians in France and Belgium, with significant diversity in protocols and notable gaps in knowledge and best practices. Both interventions are commonly used mainly for therapeutic purposes for GI disorders, yet supporting evidence remains limited and inconsistent. Although veterinarians were aware of the importance of infectious disease testing, the majority did not perform any tests on FMT donors. This underscores an urgent need to standardize equine FMT protocols, not only to improve clinical outcomes but also to establish essential biosecurity measures. Addressing these gaps through improved education, clearer product definitions and robust clinical research is essential to support evidence-based use and enhance the safety and effectiveness of these interventions for equine patients.

Author Contributions

Clémence Loublier: conceptualization, investigation, funding acquisition, writing – original draft, methodology, visualization, writing – review and editing, project administration. **Bernard Taminiau:** writing – review and editing, conceptualization, methodology. **Laurence Seidel:** formal analysis, data curation, visualization, writing – review and editing. **Nassim Moula:** formal analysis, data curation, writing – review and editing. **Colombe Tano:** conceptualization, methodology, investigation, writing – review and editing. **Carla Cesarini:** conceptualization, writing – review and editing, methodology. **Marcio Costa:** writing – review and editing. **Laureline Lecoq:** writing – review and editing. **Georges Daube:** writing – review and editing. **Hélène Amory:** conceptualization, methodology, supervision, funding acquisition, project administration, writing – review and editing.

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Ethics Statement

The present study involved a survey distributed to veterinarians. All participants took part voluntarily, and responses were anonymous. According to local regulations and institutional policies, such surveys do not require formal ethical approval.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Peer Review

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.

Supporting Information 1: Survey (scripted method) distributed to veterinarians working in France and Belgium about the use of probiotics and faecal microbiota transplantation in equine practice. **Supporting Information 2**: Table describing the veterinarian respondents in relation to probiotic use. **Supporting Information 3**: Table describing the veterinarian respondents in relation to FMT use. **Supporting Information 4**: Table describing factors influencing the effectiveness of faecal microbiota transplantation (FMT) in horses: a comparative analysis.