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Autologue Skin Microbiota Transplantation in Cats with Primary/Secondary Skin Lesions: Route for Substituting Cutaneous Integumentary System Against Allergy[A]

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Abstract: Feline integumentary environment and its biogeography might display microbial dysbiosis with an enrichment of specific pathogens, which have also been implicated in dermatological issues in cats. Primary and secondary skin lesions may be frequently observed in cats which are quite commonly underdiagnosed causing core skin microbiome default. Moreover, recent studies have supported the role of the skin microbiome in several dermatological conditions in cats; however, significant knowledge gaps remain regarding natural treatment approaches. In this context, we aimed to substitute diseased and peturbed skin microbiome with those of healthy adjacent microbiogeography by use of Nivea Refining Clear-Up Strips (Ni-RcUs) in cats with primary/secondary skin lesions. Briefly, this study employed an autologous skin microbiota transplantation (a-SmT) approach, rather than the heterologous skin microbiota transplantation (h-SmT) previously used by the same research group. The method involved transferring cutaneous microbiota from adjacent healthy tissue to dysbiotic skin of the same individual using Nivea Refining Clear-Up Strips (Ni-RCUs). In a total of 50 cats with a history of non-seasonal pruritus, miliary dermatitis, eosinophilic dermatitis, alopecia or excoriation, following tentative diagnosis of allergy, the severity and distribution of clinical dermatological lesions were assessed using SCORFAD (SCORing Feline Allergic Dermatitis) system. In this context, a-SmT has been performed on all 50 cats with a well-established methodology (by the same group of investigators of this manuscript), in which adjacent healthy tissue

[A] The study does not require approval from an ethics committee. The article has been prepared according to research and publication ethics.

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microbiome was substituted and replaced diseased skin. Following the completion of a-SmT there was significant clinical recovery in which mean excoriation, miliary dermatitis, eosinophilic dermatitis and self-induced alopecia scores were decreased [2.3 vs. 0.74, 1.52 vs. 0.42, 0.22 vs. 0.06, and 2.96 vs. 0.82, before and after treatment, respectively] ($p < 0.001$). Moreover, the mean total cumulative SCORFAD values were deemed significantly ($p < 0.001$) decreased [7.63 vs. 2.06]. In conclusion, this natural route of unmatched treatment modality should replace previously used older drug trials of immunosuppressive origin.

Keywords: Autologue Skin Microbiota Transplantation, Feline Dermatology, SCORFAD, Cutaneous Dysbiosis

Introduction

The skin microbiome, has aroused great interest and has been recognized as a central area of several selected cutaneous disorders along with gut-brain-skin axis and gut microbiome (Ural, 2024; Mahmud et al., 2022; Sun et al., 2021), and its potential usage for the purposes of medicine and cosmetics has paid marked attention (Callewaert, 2025). Skin microbiome manipulations have arisen as a new and exciting approach for treating skin lesions and has revolutionized skin care. Promising approaches include skin microbiome transplantation, skin bacteriotherapy, and the use of prebiotics, probiotics, and postbiotics. Skin microbiome transplantation involves transferring a healthy individual's microbiome to another person's skin to improve their skin condition (Callewaert et al., 2021; Callewaert, 2025).

In recent years, studies in both humans and animals have shown that the skin microbiota is not only involved in barrier functions, but also has the potential to shape the immune system and contribute to the pathogenesis of various dermatological diseases (Callewaert et al., 2021). In inflammatory skin diseases, especially atopic dermatitis, food-induced cutaneous adverse reactions (caFr) as well as ectoparasitic dermatitis, a significant relationship has been reported between the disturbed balance of the microbiota (dysbiosis) (Ural et al., 2022a) and disease severity (Ural et al., 2022b; Ural et al., 2023b; Ural et al., 2024b). Clinical observation and intervention studies in dogs have demonstrated that the physical transfer of unenriched skin microbiota from healthy individuals to diseased areas provides significant improvements in clinical parameters such as erythema and pruritus (Ural et al., 2022b; Ural et al., 2023a). For example, heterologous transplantation in dogs with scabies eliminated skin scraping positivity and significantly reduced pruritus scores (Ural et al., 2022b). Similarly, in studies conducted on cases with atopic dermatitis and caFr diagnosis, the abundance of pathobiotic species such as *Staphylococcus spp.* decreased after skin microbiota transplantation (SMT) application, and epidermal hydration values and pH parameters improved significantly (Ural et al., 2023a; Ural et al., 2024a).

These findings show that skin microbiota is not only a disease indicator but also an intervenable therapeutic target. In addition, it has been shown that simple, non-invasive tools used in SMT applications (e.g. Nivea Clear-Up Strips) can be effective in dermal transfer, and this approach has been evaluated as a new strategic expansion in veterinary dermatology (Ural et al., 2023a).

This study aimed to evaluate the potential of modulating cutaneous dysbiosis in cats with primary or secondary skin lesions by transplantation of autologous and unenriched skin microbiota to lesional areas (a-SMT) and to investigate the therapeutic effects of this method on objective parameters such as SCORFAD scores, global assessment score and clinical follow-up parameters.

Materials and Methods

Animals

Fifty client owned cats of different breeds (the most commonly represented were Persian, British short hair, Scottish, Angora, and cross-bred) sexes (34 female and 16 male), and ages ranging from 3 to 10 years old were enrolled in the study. All cats had an existing with a history of non-seasonal pruritus and presented at least one characteristic of skin lesions, including miliary dermatitis, eosinophilic dermatitis, alopecia, or excoriation. Prior to enrolment, flea bite hypersensitivity was excluded through the administration of appropriate ectoparasitic treatments. Bacterial and fungal skin infections were ruled out based on cytological examination; however, no antimicrobial or antifungal treatments were administered. Food allergies were addressed using a six-week elimination diet with Virbac Gastro®; however, this protocol could not be completed in some cases. Each cat received orally 2-3 ml Gut-cumin I liquid sol. (Larek Tarım, Ankara) per orally once daily for 10 consecutive days. Clinical assessments were performed both before and after the treatment period. This study was conducted as a single-arm clinical observation in which each case served as its own control to assess the before–after effect of SMT.

Skin Microbiota Transplantation Methodology

The previously established and presented methodology (Ural et al., 2022; Ural et al., 2023a, Ural et al., 2023b; Ural et al., 2024a; Ural et al., 2024b) of the same researcher group, which were also adopted and partially changed in this study, was deemed viable (Table 1, Figure 1). Moreover, solely a-SmTm was preferred, without any other relevant heterologue origin of healthy cats were included.

Table 1. Methodology of a-SmT among enrolled cats similar to those that have been described elsewhere previously (Ural et al., 2022b; Ural et al., 2023a; Ural et al., 2023b; Ural et al., 2024a; Ural et al., 2024b)

Cut	- donor skin was clipped partially, from healthy adjacent tissue close to diseased/lesional site
Copy	-Nivea Refining Clear-Up Strips (Ni-RcUs) were unboxed -both the healthy and clipped donor tissue and the recipient diseased tissue were moisturized with Lactated Ringers Solution -Ni-RcUs were stuck to moisturized healthy skin for 10 minutes
Paste	-Ni-RcUs were peeled of, which were then conveyed onto the lesional area of a diseased era for 10-15 minutes -As a final step, the relevant Ni-RcUs were removed

Figure 1. Stages of a-SmTm in a cat. A) cut (healthy skin tissue adjacent and close to the lesional areas were clipped) and B) copy (Ni-RcUs were attached), C) paste (Ni-RcUs were substituted and placed onto the lesional area for changing cutaneous microbiome).

Outcome Measures

For the evaluation of skin lesions, the proportion and severity of each lesional type were classified on an initial day (D0) and day 10 using SCORFAD scaling (Steffan et al., 2012). In this scale, lesions of the excoriation, eosinophilic dermatitis, miliary dermatitis, and self-induced alopecia patterns were evaluated. The proportions and the severity of selected clinical patterns were recorded on ten different body regions (from head to tail) with a 4-point scale with five degrees of severity [none (0) to severe (4)]. Even in cases multiple existing lesion sites were observed, summing of every selected pattern scores were added for cumulative SCORFAD value (ranged from 0 to 16) (Steffan et al., 2012).

Clinical Scoring

The severity and distribution of clinical dermatological lesions were assessed using SCORFAD (SCORing Feline Allergic Dermatitis) system. This validated method permits for a standardized estimation of four lesion types commonly associated with feline hypersensitivity disorders: a) excoriation, b) miliary dermatitis, c) eosinophilic dermatitis, and d) self-induced alopecia. In this study, "self-induced alopecia" were recorded as alopecia regardless of the underlying behavioral component.

Each lesion type was independently assessed across ten predefined anatomical regions: head, neck, dorsal and lateral thorax, flanks, rump and tail, sternum and axilla, abdomen, perineal area, and forelimbs and hind limbs including paws. In each body region, the severity of every lesion type was scored on a five-point numerical scale ranging from 0 (no lesion) to 4 (severe involvement). The regional scores for each lesion type were summed, resulting in an individual total lesion score per cat, with a maximum possible score of 16 for each lesion type.

All clinical scoring was completed by the same investigator to ensure reliability and reduce interobserver variability. Evaluations were conducted on Day 0 (before treatment) and again on Day 10 (after treatment).

In addition to scoring, an overall clinical response was evaluated using a five-point Global Assessment Scale (Steffan et al., 2012) at the end of the treatment period (Day 10). The response categories were defined as follows: 0 = excellent, 1 = good, 2 = acceptable, 3 = poor, and 4 = bad. This scale was used to provide a general impression of treatment success based on the overall dermatological condition. The evaluation was performed by the same investigator, considering all clinical findings and alterations observed throughout the treatment period. A treatment response was considered successful if the global score was rated as 0 or 1. Scores of 2 or higher were interpreted as insufficient or not optimal clinical responses.

Statistical Analyses

Obtained data were analyzed via SPSS 29.0 (IBM, USA) and graphs were visualized by Microsoft Excel. Descriptive statistics were tabulated as mean, median, minimum and maximum values for each clinical symptom. Wilcoxon signed-rank test was used to assess the differences between before and after treatment measurements. A value of $p<0.05$ was considered statistically significant in all tests.

Results

SCORFAD biomarkers, were individually and separately scored (modified through separation solely) and mean, median, min-max values were shown below on Table 2 and Figure 2.

Table 2. SCORFAD biomarkers, were individually and separately scored along with mean, median and min-max values.

	Before Treatment				**After Treatment**				***P value***
	Mean	**Median**	**Min**	**Max**	**Mean**	**Median**	**Min**	**Max**	
Excoriation	2.3	3	0	4	0.74	1	0	2	0.001
Miliary dermatitis	1.52	1	0	4	0.42	0	0	2	0.001
Eosinophilic dermatitis	0.22	0	0	1	0.06	0	0	1	0.001
Self-induced alopecia	2.96	3	0	4	0.82	1	0	2	0.001

There was a significant improvement in all clinical symptoms after treatment. The excoriation score decreased from an average of 2.3 before treatment to 0.74 after treatment. Miliary dermatitis scores decreased from 1.52 to 0.42 and eosinophilic dermatitis scores decreased from 0.22 to 0.06. Similarly, the mean score for self-induced alopecia decreased from 2.96 to 0.82. There was also a remarkable decrease in the median values for all symptoms; the minimum and maximum scores were also significantly lower after treatment (Figure 1, Table 1).

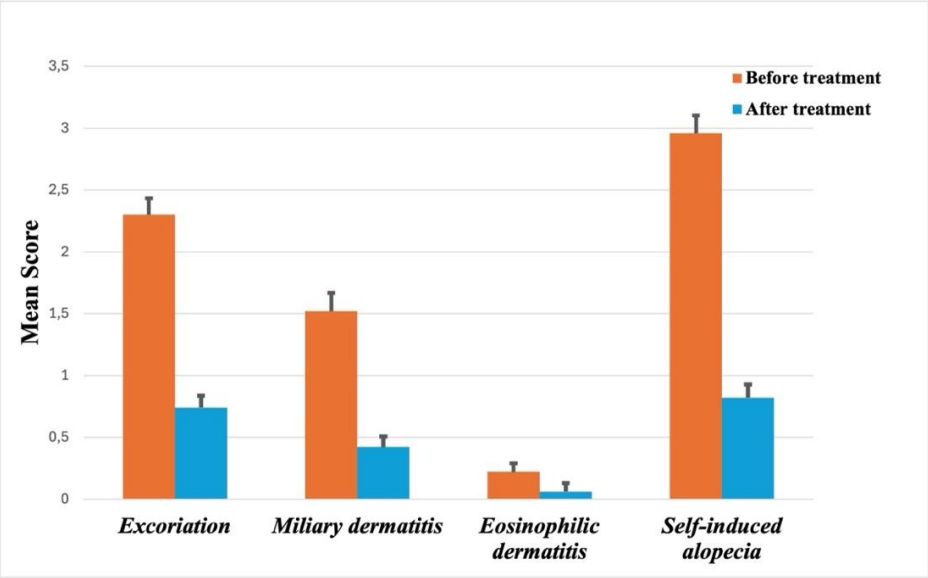

Figure 2. Bar graph of individual SCORFAD variants before and after treatment

Table 3. SCORFAD biomarkers, were individually and separately scored along with mean, median and min-max values.

	Before Treatment		After Treatment		*P value*
	Mean	**SD**	**Mean**	**SD**	
SCORFAD	7.63	1.98	2.06	1.62	0.001

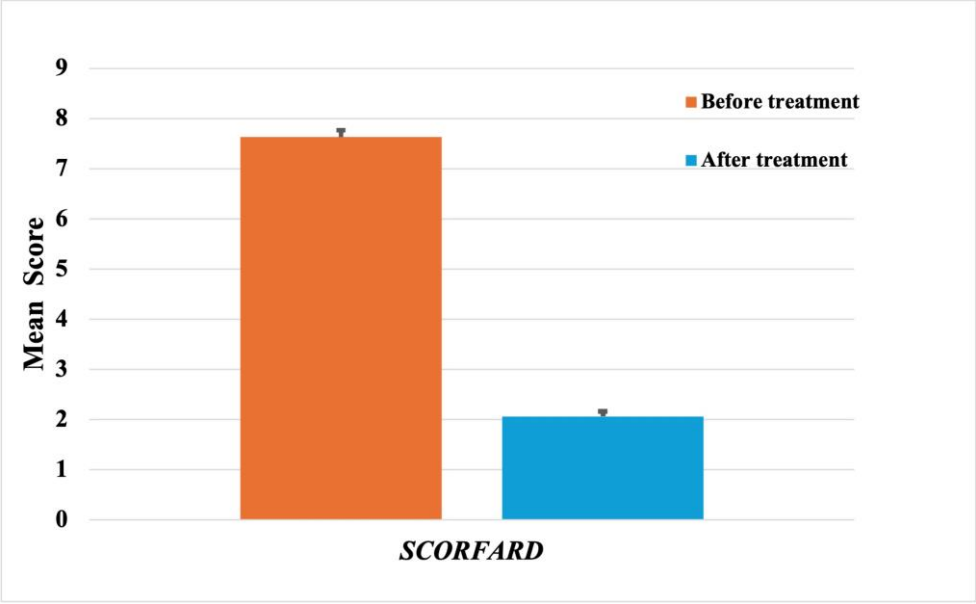

Figure 3. Bar graph of individual SCORFAD variants before and after treatment.

Global Assessment Score

The overall clinical status of the 50 cases included in the study was evaluated using the Global Assessment Scale before and after treatment (Figure 4). In the pre-treatment period, 52% of the cases were categorized as "bad" (score 4), 38% as "poor" (score 3), 6% as "acceptable" (score 2), and 4% as "good" (score 1). No cases were classified as "excellent" (score 0) at baseline. After treatment, 34.4% of cases were evaluated as "excellent", 26.2% "good", 22.9% "acceptable", and 16.4% as "poor". No cases remained in the "bad" score (Table 4).

Table 4. Distribution of global assessment scale scores

Score	Before (n)	After (n)	Before (%)	After (%)
0	0	21	0.0	34.4
1	2	16	4.0	26.2
2	3	14	6.0	22.9
3	19	10	38.0	16.4
4	26	0	52.0	0.0

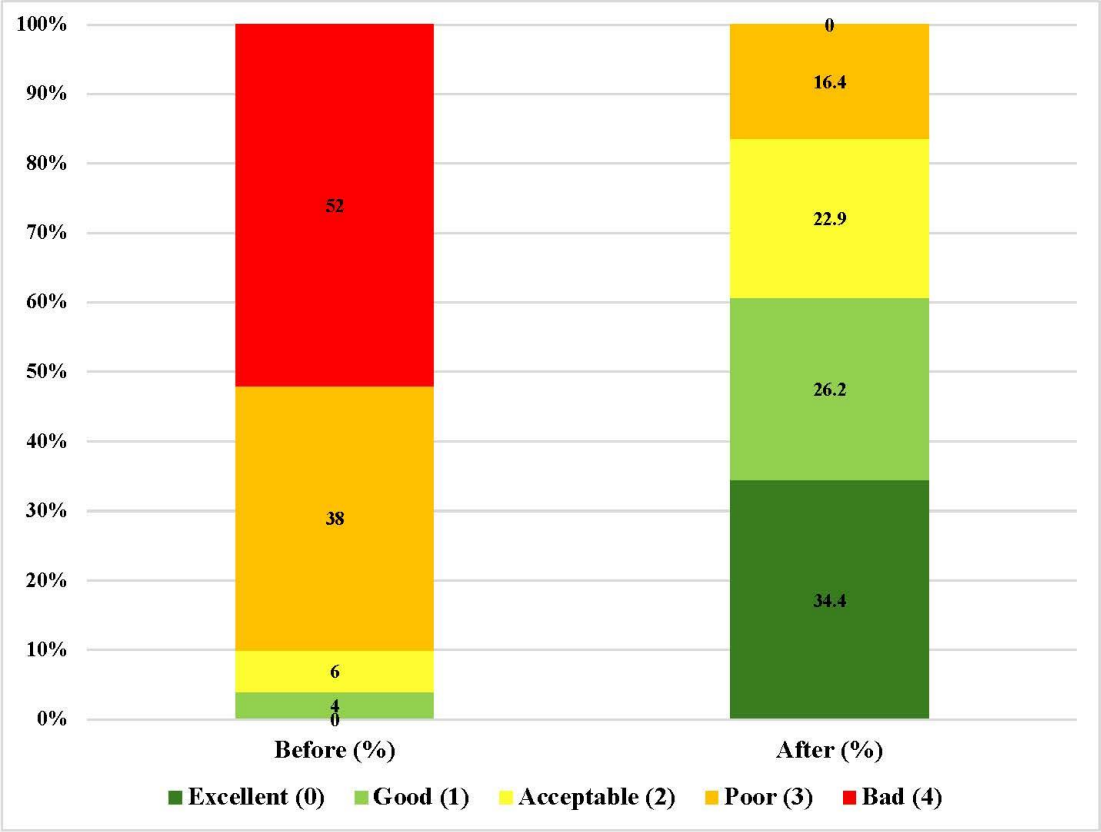

Figure 4. Global Assessment Scale before and after treatment

Clinical Records of Selected Cases

Selected high resolution photographs of some the 50 cats in the study are shown in Figure 5-11.

Figure 5. A cat with excoriation, miliary dermatitis and secondary dermatophytosis that responded to a-SmT. Photographic records were taken weekly from week 1 to 7.

Figure 6. Mimicking hypereosinophilic syndrome (with leukopenia of had a duration of several years) that responded both to fecal microbiota transplantation and a-SmT, at the same time.

Figure 7. Head and neck dermatitis that responded to a-SmT, before (day 0) and after treatment (day 21)

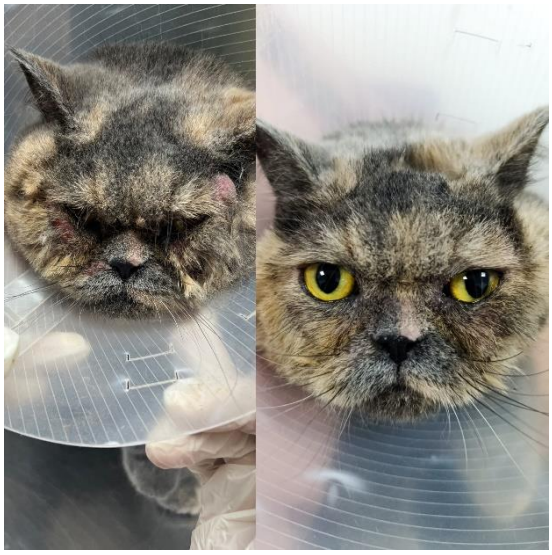

Figure 8. Head and neck dermatitis in a cat that responded to a-SmT. The photographic records were taken on day 0 and day 14.

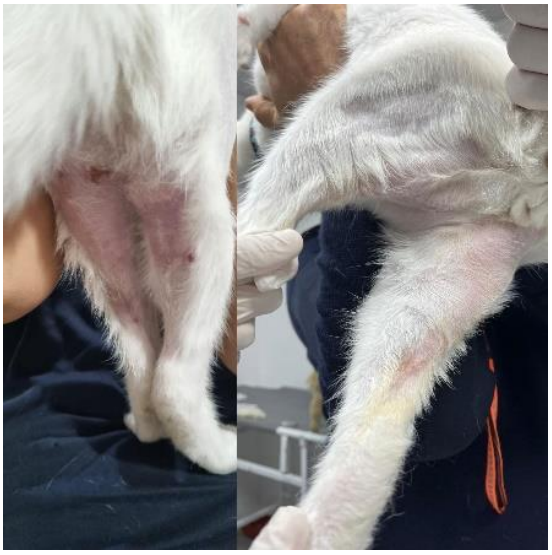

Figure 9. Linear dermatitis also involving cat litter and contact, in which a-SmT was capable of reversing clinical signs and disease activity.

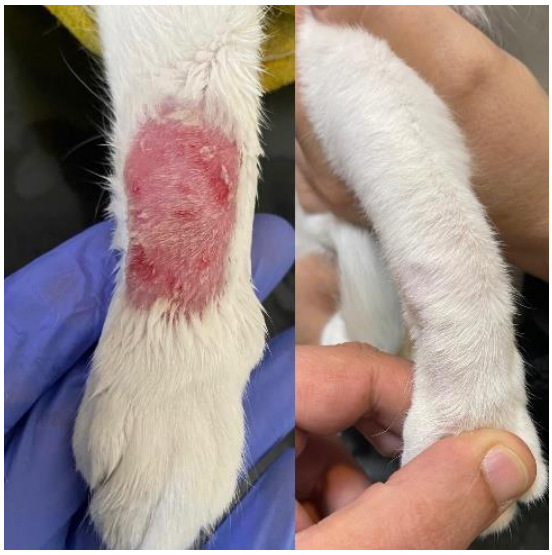

Figure 10. Localized forelimb dermatitis resolved after a-SmT. Day 0 (left) and day 21 (right).

Figure 11. Facial dermatitis with periorbital crusting before and after a-SmT. Day 0 (right) and day 7 (left).

Discussion

Semi-depth and Selected Literature Accumulation on Human Health

SMT could comprise transfer of the entire cutaneous microbiota, if available, from a healthy donor or via an artificial blend of some microorganisms (Junca et al., 2022). SMT methodology has been utilized through matching between donor and recipient microbiome specifity and transplantation load, accompanied by several factors influencing the engraftment process (Boxberger et al., 2021). It has been explored that SMT through entire cutaneous microbiome between dissimilar anatomical sites could make a copy of specifical microbial efficacy, to those of odor-causing bacteria from the armpit could be transferred to the forearm (Callewaert et al., 2021). Regarding the previous description of conveying microbiome via swabs from the arm to the back, exhibited prominent diversity within the inner elbow in comparison to the back. After transfer, 4 arm-specific species

(*Gardnerella*, *Brachybacterium*, and *Actinomyces* the vast majority) grew predominantly on the back within one day (Callewaert et al., 2021). Another human study that involved enrolled siblings, to those of whom with strong body odor. SMT from the non-odorous sibling into the sibling with body odor, resulted in reduced body odor along with a novel equilibrium composed of increased *staphylococci* and decreased *corynebacteria* (Callewaert et al., 2021).

Evidence So Far in Veterinary Dermatology Perspective for Skin Microbiome Manipulation

From a historical perspective of SMT for the authors of this manuscript and their academic colleagues, the manipulation of skin biogeography has been performed for a considerable period. In pioneering research conducted by the author's using SMT Ni-RcUs was re-performed on days 5 and 12 for alleviating erythema among dogs. In that study both visual analogue scale erythema severity score and Atopic Dermatitis Area and Severity Index were diminished via a-SmT induced clinical recovery in dogs with atopic dermatitis (Ural et al., 2023a). Unenriched SMT (Un-SMT) was performed to treat feline atopic skin syndrome through Ni-RcUs, either in autologue/heterologue conveying. In that study, Feline Dermatitis Extent and Severity Index and Visual Analogue Scale (VAS) pruritus scores were significantly ($p=0.001$) decreased on day 10 in contrast to baseline values of day 0, switched the severity of the disease activity and exhibited treatment success (Ural et al., 2023b). In a case report of 2 dogs, the feasibility of conveying unenriched cutaneous microbiota niches between two heterologous hosts, h-SmT, (withdrawn sample of healthy donor conveyed into diseased recipient dog) with scabies were inspected. Ni-RcUs were stuck to healthy cutaneous sites of a healthy donor dog and were allowed to dry for 10-12 minutes. Afterwards strips were peeled off and then conveyed to diseased skin sites. In both cases, VAS pruritus scores were strikingly diminished from day 0 (initial h-SmT day) to day 21. That study conveyed unenriched skin microbiota from a healthy donor to a dog with scabies, without any drug application prompted and established clinical and parasitological recovery, and had never been reported previously (Ural et al., 2022b).

Industrial Effects and Its Significance

Conveying or substitution of live microorganisms from healthy donors to diseased brings along some risks, warranting pathogen identification/detection standards (Junca et al., 2022). Moreover, formulized microbiome assembling, construction, and storage conditions are warranted in an attempt to interpret SMT efficacy (Junca et al., 2022). Comprehension for microbiome interplay and pathological mechanisms also involving functioning might assist bespoke (inter-individual) therapeutic armamentarium with the purpose of specific cutaneous microbiota functions (Junca et al., 2022).

In the present study we preferred a-SmT, and during the trials there were no side effects in any of the cats enrolled herein. No complications were evident. Taking into account the efficacy of SMT on clinical field, it would not be unwise to draw a preliminary conclusion that previous investigations (Ural et al., 2022a; Ural et al., 2023a; Ural et al., 2023b; Ural et al., 2024a; Ural et al., 2024b) and the one that is reported herein and performed by the same researchers, with entirely satisfactory results should replace unnecessary immunosuppressive or drug usage. Moreover, this treatment modality has the potential to be superior to the vast majority of classic older treatment trials to recovery by switching to this natural treatment modality.

Against All Odds and Parts That Remained Unclear

What is the current state of the current level of expertise with a-SmT or h-SmT among veterinary surgeon skills in our country? Those of solely limited to selected veterinary surgeons educated by our researcher team or who have

received education, courses, webinar or seminars are capable of using this technique with satisfactory results in field applications with documented success. It is reasonable to draw preliminary conclusions that the Intestinal Permeability Measurement Center, abbreviated as İPÖM, has been at the center of a-SmT or h-SmT with relevant studies published (Ural et al., 2022a; Ural et al., 2023a; Ural et al., 2023b; Ural et al., 2024a; Ural et al., 2024b; Ural et al., 2025) which are open sources for relevant veterinary surgeons. Apart from that, without experienced skills, no one would be capable of using these natural treatment modalities. Specifically, the prevention of an increase in intestinal permeability, the restoration of intestinal and epidermal integrity (denoting the withdrawal of leaky skin and leaky gut) are crucial. Someone might criticize us for not performing microbiota analysis at the time of establishing study. As this was a self-budget research without any financial support, we were unable to analyze skin microbiota prior to and after SMT. However, we may speculate that this technique was capable of changing cutaneous environments as was evidenced by clinical recovery supported by outcome measures.

Conclusion

In conclusion, a-SmT is a safe, simple and practical treatment technique for reducing cutaneous dysbiosis and increase dermatological lesions in cats. Significant reductions in SCORFAD scores (Table 3 and Figure 3) and clinical assessments emphasize the therapeutic potential as a natural, non-invasive alternative method to routine immunosuppressive treatments. Further studies with microbiome analyses are warranted and the present findings support a-SmT as a hopeful treatment assessment that might redefine new approaches in feline dermatology.

Conflict of Interest

The author(s) declare that there is no conflict of interest regarding the publication of this manuscript.

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