

The Influence of Topical Unsaturated Fatty Acids and Essential Oils on Normal and Atopic Dogs

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ABSTRACT

Seven dogs with atopic dermatitis and six normal dogs were treated with a spot-on product containing essential oils and unsaturated fatty acids q 7 days for 8 wk. Seven additional atopic dogs received a daily spray containing similar ingredients to the spot-on. In all dogs, transepidermal water loss (TEWL) was measured before and after treatment using a closed chamber device. In atopic dogs, a validated lesion score (canine atopic dermatitis extent and severity index, CADESI) was determined and pruritus was assessed with a visual analog scale before and after treatment. The mean CADESI scores in atopic dogs decreased with the spot-on ($P=0.0043$) and with the spray ($P=0.0366$). Similarly, the pruritus scores decreased with the spot-on ($P=0.266$) and with the spray ($P=0.0177$). There was a significant difference between the TEWL values of healthy and atopic dogs on the abdomen ($P=0.0181$) and back ($P=0.0123$). TEWL decreased significantly on the back after treatment with the spray ($P=0.016$), but not on the abdomen ($P=0.078$). Adverse effects were not observed. The results of this pilot study indicate that topical fatty acids and essential oils are a useful treatment option for canine atopic dermatitis. (*J Am Anim Hosp Assoc* 2011; 47:236–240. DOI 10.5326/JAAHA-MS-5607)

Introduction

Canine atopic dermatitis is a common disease in small animal practice. A number of treatment options are available that vary in success rate and adverse effects.¹ Fatty acids have been used in the past to treat humans, dogs, and cats with atopic dermatitis.^{2–4} They have been variably given as food supplements^{5,6} or incorporated into commercial diets aimed at relieving dogs with allergic skin disease.^{7,8} Their mechanism of action is unclear, but a decrease of inflammatory mediator production, an influence on epidermal barrier function, and an inhibition of cellular immunity have all been considered.^{9–11} Atopic dermatitis is a complex multifactorial disease with changes including increased IgE production against environmental or dietary antigens, increased numbers and activity of inflammatory cells in the skin, and changes in the composition of the epidermis affecting the barrier function.^{12–14} Transepidermal water loss (TEWL) reflects the skin barrier function in humans and dogs and can be measured.^{15,16} Recently, a new product available in both spot-on and spray

formulation containing essential oils and unsaturated fatty acids was introduced to veterinary medicine. This product has been shown to improve smell and shine of the coat and to decrease scaling. The aim of this pilot study was to evaluate the influence of topically administered essential fatty acids on the TEWL of normal and atopic skin and on the clinical signs of canine atopic dermatitis.

Materials and Methods

Study Design

The study was carried out as a randomized study. The atopic dogs were assigned to the two treatment groups using a table of random numbers and simple randomization.

Patients

Six normal dogs with no evidence of disease on history and clinical examination and 14 atopic dogs were included in the study. Atopic dermatitis was diagnosed by history; clinical examination; and

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CADESI canine atopic dermatitis extent and severity index; TEWL transepidermal water loss

ruling out differential diagnoses with tests and treatments such as flea control, skin scrapings, or trial therapy against superficial mites, as indicated. Cutaneous infections with bacteria (such as *Staphylococcus pseudintermedius*) and yeast (such as *Malassezia pachydermatis*) were ruled out with clinical examination and cytologic evaluation of impression smears.

Withdrawal times prior to the study of previously administered symptomatic medications were at least 6 wk for systemic glucocorticoids and at least 2 wk for topical glucocorticoids and antihistamines. Essential fatty acids were not allowed to be administered within the 4 mo immediately prior to the study. All other topical therapy was discontinued 3 wk prior to inclusion in the study with the exception of flea and tick control. Those patients with clinical signs or a history of flea bite hypersensitivity received fipronil^a q 1 mo throughout the study. Allergen-specific immunotherapy was permitted as long as it had been initiated >12 mo before the study. The dose and frequency of these permitted concurrent therapies was not permitted to be changed during the study.

Intervention

Dogs were administered either a spot-on^b containing essential oils and unsaturated fatty acids or a spray^c containing comparable, but different, essential oils and unsaturated fatty acids, as well as other natural active ingredients. The owners performed the treatments themselves for a period of 8 wk. The spot-on product was applied q 7 days and the spray was applied q 24 hr.

Clinical Evaluation

Clinical scores for pruritus and for lesions were obtained before and after 8 wk of therapy. Pruritus was determined by a validated and reported pruritus score.^{17,18} A validated lesion score, the canine atopic dermatitis extent and severity index (CADESI), was determined by a clinician as previously reported.^{19,20} In short, 46 body sites were evaluated for markers of acute inflammation (erythema), chronic inflammation (lichenification), trauma (excoriation), and alopecia on a scale of 0 (nonexistent) to 5 (severe). The total score was calculated. Adverse effects were also recorded.

TEWL Measurement

At the first visit prior to beginning treatment and the last visit after 8 wk of therapy, TEWL was measured by a clinician with a closed chamber VapoMeter^d. An ambient temperature of 20–26°C was maintained during measurement. The three areas selected for measurement were the dorsal neck (between the scapulae), dorsal midback (between the ilia), and ventral abdominal area (next to the umbilicus). Before each use of the VapoMeter, a 2 cm × 2 cm

site in each of the three areas was gently clipped using a number 40 clipper blade. Each region was then measured sequentially five times. The mean TEWL value was calculated.

Statistical Analysis

The CADESI, pruritus scores, and TEWL values at the beginning of the study and after 8 wk of treatment were compared between the three groups with analysis of variance and Tukey test. Nonparametric data were evaluated with a Kruskal-Wallis test and Dunn test. Results within each group were compared with a paired *t* test or (with nonparametric data) a Wilcoxon matched-pairs test. A paired *t* test or (with nonparametric data) a Mann-Whitney *U* test was used to compare the changes from baseline in the TEWL values measured in the different groups. A *P* value of <0.05 was considered significant. Analysis was performed with the Graphpad 4.0 and Instat 3.06 Software^e.

Results

Clinical Evaluation

There was no significant change in CADESI or pruritus scores in the normal dogs. In 13/14 atopic dogs, the CADESI score decreased from a mean of 27.2 before to a mean of 10.7 after treatment. The CADESI scores decreased in atopic dogs from 25.1 (15.8–34.5) to 15.3 (5.3–25.3) when using the spot-on formulation (paired *t*-test, *P*=0.0043) and from 29 (6.1–52.4) to 6 (2.8–9.8) when using the spray formulation (paired *t*-test, *P*=0.0366). Although CADESI scores after treatment with the spray were lower than after spot-on therapy after 8 wk of treatment, this difference was not statistically significant. In 9/14 atopic dogs, the pruritus score decreased from 2.6 before treatment to 1.7 after treatment. The pruritus scores decreased in atopic dogs from 3.1 (1.2–5.1) to 2.1 (0–4.3) when using the spot-on (paired *t*-test, *P*=0.266) and from 2.3 (0.6–4.0) to 1.3 (0.009–2.6) when using the spray (paired *t*-test, *P*=0.0177). There was no significant difference between the spray and spot-on.

TEWL Measurement

The mean values of TEWL are listed in **Table 1**. When comparing individual sites, there was a significant difference between the TEWL values of healthy and atopic dogs on the abdomen (unpaired *t* test, *P*=0.0181) and back (unpaired *t* test, *P*=0.0123). There was no difference on the neck (*P*=0.484).

TEWL did not decrease significantly in the atopic dogs receiving spot-on, which were 13.1 g/m²hr before treatment and 11.9 g/m²hr after treatment (paired *t* test, *P*=0.5168). Similarly, the atopic dogs receiving spray did not show a significant decrease in their TEWL, which decreased from 11.5 g/m²hr to 9.9 g/m²hr

TABLE 1**TEWL Values (g/m²hr) of Atopic and Healthy Dogs Measured at the Time of Inclusion in the Study**

Anatomic site	Atopic dogs	Healthy dogs
Neck	13.3 (6.6–20.8)	13.3 (9.9–16.7)
Back	16.2 (6.1–24.6)	11.4 (9.3–15.4)
Abdomen	12.1 (7.3–34.9)	10.1 (9.3–14.1)

Data are presented as mean (range). TEWL, transepidermal water loss

(paired *t* test, *P*=0.09). When the sites were evaluated separately, there was a significant decrease in TEWL on the back after treatment with the spray (Wilcoxon matched-pairs test, *P*=0.016). On the abdomen, there also was a trend for a decrease in TEWL; however, this difference was not statistically significant (Wilcoxon matched-pairs test, *P*=0.078).

Adverse Effects

All dogs included in the study completed the study. Adverse effects were not seen in any of the dogs.

Discussion

In this study, the topical application of either a fatty acid containing spot-on or spray improved both the lesions and pruritus in dogs with atopic dermatitis. The spray significantly decreased the TEWL on the back, despite the small group size of seven dogs. There was a trend toward a reduction in TEWL on the abdomen.

A number of studies have evaluated the treatment of canine atopic dermatitis with orally administered essential fatty acid supplements. Benefits have been reported with omega-3 and omega-6 fatty acids, as well as with combinations of the two.^{6,21–23} More recently, commercial diets with high fatty acid contents have been shown to improve clinical signs of the disease; however, the mechanism(s) of action remain(s) unclear.^{7,24} A decrease in the production of leukotriene B₄ by neutrophils has been shown after feeding omega-3 fatty acids to normal dogs.^{11,25} Leukotriene B₄ concentration in the skin of atopic dogs did not change after fatty acid supplementation²⁶ and leukotriene inhibitors or leukotriene receptor antagonists did not improve the pruritus associated with atopic dermatitis in dogs, questioning the relevance of this effect for canine atopic dermatitis.^{27,28}

In the atopic dogs in this study, a significant decrease in lesion scores was seen with the weekly spot-on as well as the daily spray. The decrease was more pronounced with the spray, which is probably due to the increased amount of fatty acids administered onto the skin by daily application compared with a weekly spot-on. Pruritus was also decreased in the majority of dogs, but this decrease was only significant in the group that was sprayed. Interestingly,

direct comparison of the two groups revealed no significant difference between them. This may be due in part to the improvement seen with both treatments and subsequent smaller difference between the groups than between baseline and the final evaluation. Another explanation may be the relatively small group size.

The stratum corneum and its barrier function are influenced by oral fatty acid composition, as noted in one study including seborrheic dogs fed foods with varying fatty acid content.²⁹ TEWL loss has been shown to reflect skin barrier function in humans and dogs, and is increased in individuals with atopic dermatitis compared with normal controls.^{15,16,30} Closed chamber devices are influenced by temperature and humidity, and have been used preferentially to measure TEWL in dogs.³¹ In this study, the temperature of the examination room was always between 18°C and 22°C, the preferred temperature range. The same clinician measured TEWL at the same time of day, with the same method, and at the same sites. This is important, as different sites show different TEWL.³¹ In a previous study of healthy dogs, the head and shoulders showed the highest TEWL, and the abdomen the lowest.³¹ In this study, similar results were obtained: the lowest TEWL values were on the abdomen and the highest TEWL values were on the neck of the normal dogs. In the atopic dogs included in this study, the TEWL was higher on the abdomen and back, and decreased with the spray, but not with the spot-on therapy. This may reflect lower concentrations of fatty acids achieved in the skin after weekly spot-on compared with daily spray application. Whether a prolonged treatment time or higher dosing (administration at two sites, for example) of the weekly spot-on would have further improved TEWL is not known and requires further study.

Clinical improvement in atopic dogs was much more pronounced than the decrease in TEWL. Immunomodulatory activity by omega-3 fatty acids has been reported in humans.³² Another study reported that incubation of canine peripheral blood mononuclear cells with fatty acids led to reduced T cell proliferation.¹⁰ Furthermore, a difference in fatty acid profile of normal and atopic dogs has been identified in erythrocytes, but not plasma, emphasizing the importance of cellular fatty acid concentrations.³³ Possibly, in addition to the influence on TEWL, other mechanisms add to the anti-inflammatory effects of these topical fatty acids.

The most common adverse effect seen with oral fatty acid therapy is diarrhea. No adverse effects were observed in any of the dogs in the study. In human studies, decreased platelet aggregation has been observed *in vitro* in patients receiving fish oil.³⁴ Other studies found no change after omega-3 fatty acid supplementation.³⁵ In dogs, no clinically relevant changes were identified after oral

supplementation.³⁶ Monitoring with coagulation profiles was not performed in this study.

There are several limitations of this study. First, the group size was small, limiting the power of the study; however, achieving statistically significant results with a small group size is very encouraging. Second, only dogs with mild to moderate disease were included in the study. It has been previously proposed to separate severely affected dogs from dogs with mild or moderate atopic dermatitis due to possible different success rates of various interventions in these subgroups.²⁰ Thus, no conclusions can be drawn here on the effect of topical fatty acids on dogs with severe atopic dermatitis. It is notable that all enrolled dogs completed the study, supporting the fact that this treatment is practical and was well accepted by the owners; however, owners of dogs visiting the authors' clinic with severe atopic dermatitis likely would not have agreed to cease other medications to be included in this study.

Conclusion

Clinical improvement was seen with the topical administration of essential oils and fatty acids on atopic dogs applied either as a daily spray or a weekly spot on. Benefits seemed to be more pronounced with the spray formulation. A statistically significant change in TEWL was seen with the daily spray on the back and abdomen. Thus, this therapy may be a convenient and safe treatment option for canine atopic dermatitis. ■

The authors would like to thank Dr. Sonya Bettenay for helpful suggestions with the manuscript and the Laboratoire de Dermo-Cosmétique Animale for sponsoring the study.

FOOTNOTES

- ^a Frontline spot-on; Merial, Hallbergmoos, Germany
- ^b Dermoscent Essential 6; Laboratoire de Dermo-Cosmétique Animale, Technopôle Castres-Mazamet, Castres, France
- ^c Dermoscent Atop 7; Laboratoire de Dermo-Cosmétique Animale, Technopôle Castres-Mazamet, Castres, France
- ^d Vapometer; Delfin Technologies Ltd, Kuopio, Finland
- ^e Graphpad Software, San Diego, CA

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