

Evaluation of the correlation between Scoring Feline Allergic Dermatitis and Feline Extent and Severity Index and skin hydration in atopic cats

Marcin P. Szczepanik* , Piotr M. Wilkołek*, Łukasz R. Adamek*, Marcin Zająć†, Marcin Gołyński‡, Wiesław Sitkowski* and Iwona Taszkun*

*Subdepartment of Clinical Diagnostics and Veterinary Dermatology, Faculty of Veterinary Medicine, University of Life Sciences in Lublin, Głęboka 30, 20-612 Lublin, Poland

†Private veterinary practice Bafir, ul. Szpitalna 9a, 41-250 Czeladź, Poland

‡Subdepartment of Internal Diseases of Farm Animals and Horses, Faculty of Veterinary Medicine, University of Life Sciences in Lublin, Głęboka 30, 20-612 Lublin, Poland

Correspondence: Marcin P. Szczepanik, Subdepartment of Clinical Diagnostics and Veterinary Dermatology, Faculty of Veterinary Medicine, University of Life Sciences in Lublin, Głęboka 30, 20-612 Lublin, Poland. E-mail: kryll@poczta.onet.pl

Background – Evaluation of the severity of clinical signs of cats with allergic skin diseases has used two scoring systems: Scoring Feline Allergic Dermatitis (SCORFAD) and the Feline Extent and Severity Index (FeDESI). The integrity of the cutaneous barrier can also be evaluated by measuring skin hydration. A correlation between the clinical score and skin hydration has been observed in humans and dogs with atopic dermatitis (AD).

Hypothesis – To demonstrate a correlation between the clinical score and skin hydration of cats affected with presumed AD.

Animals – European short hair cats ($n = 18$): 11 females and seven males with a confirmed diagnosis of AD.

Methods – SCORFAD and FeDESI scores were calculated and the measurements of skin hydration were assessed from seven body sites using corneometry. The correlation between the SCORFAD and FeDESI systems and skin hydration of each site, and the average skin hydration was calculated.

Results – There was a positive correlation between the SCORFAD score and skin hydration for the axilla, thorax and forelimb; for FeDESI and axilla and lumbar sites. There was a negative correlation between the FeDESI and skin hydration for the pinna ($r = -0.47$).

Conclusions and clinical importance – Measurements of skin hydration could be a useful tool for the evaluation of allergic cats. There is limited evidence of any useful correlation between clinical scoring systems and measurements of hydration. The pinna may be a suitable region for the assessment of skin barrier function in normal and allergic cats.

Introduction

Feline atopic dermatitis (AD) is reported to be a common allergic dermatosis in cats.¹ Affected cats present with pruritus affecting the head and neck, self-induced alopecia, miliary dermatitis and eosinophilic granuloma complex.² Two scoring systems have been used to define the severity of skin lesions for affected cats: SCORFAD (Scoring Feline Allergic Dermatitis) and FeDESI (Feline Extent and Severity Index).³ The SCORFAD system is partially validated and evaluates four lesion types: abrasions, eosinophilic plaques, miliary dermatitis and self-induced alopecia, based on a 0–4 scale.⁴ An affected cat

can therefore score a maximum of 16 points. The FeDESI system has not been validated and is based on a modification of the Canine Atopic Dermatitis Extent and Severity Index (CADESI) scoring system; it applies a score of zero to five for erythema, abrasions/erosions and self-induced alopecia for 42 body sites. An affected cat can therefore score a maximum of 630 points.⁵

Evaluation of the integrity of the cutaneous barrier can be achieved by measuring of biophysical parameters such as trans epidermal water loss (TEWL), skin hydration (SH), skin pH or severity of erythema. Trans epidermal water loss has been reported for healthy dogs, cats and horses, and for dogs and cats with AD.^{6–12} A correlation between the severity of clinical signs using the CADESI method and TEWL has been reported for the dog.¹² Skin hydration appears to correlate with the severity of clinical signs of some affected body sites of atopic dogs, namely the groin and interdigital regions.¹³

Skin hydration parameters have only been reported for healthy cats; there are no published studies evaluating the correlation between skin hydration and clinical scores in cats affected with AD. The objective of the study was

Abbreviation: CADESI, Canine atopic dermatitis extent and severity index; FeDESI, Feline Extent and Severity Index; SCORFAD, Scoring Feline Allergic Dermatitis; TEWL, trans epidermal water loss.

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to determine whether there was a correlation between skin hydration (assessed at seven different body sites) and the two scoring systems for evaluating of lesion severity: FeDESI and SCORFAD in atopic cats. It was hypothesized that if a correlation could be demonstrated, measurements of skin hydration could be used as an objective method to assess severity of the disease and could provide a useful tool to monitor responses to treatment.

Materials and methods

Measurements were collected from 18 European short hair cats: 11 females (five neutered) and seven males (all neutered), aged two to seven years (median 3.75 years) with the diagnosis of AD. Owners provided consent for each cat to participate in the study. The diagnosis of AD (nonflea, nonfood-induced hypersensitivity dermatitis) was based on published criteria. For each cat, at least six diagnostic criteria were met.² Other pruritic diseases were ruled out based on trichoscopic examination, skin scraping and microscopic examination, and cytology. All cats were diet trialled for eight weeks and all were administered anti-flea prophylactic products to rule out flea allergy. Baseline data for the cats used in the study is given in Supporting Information Table S1.

Evaluation of skin hydration and calculation of SCORFAD and FeDESI

The measurements of skin hydration and calculation of SCORFAD and FeDESI were performed at the initial visit and prior to treatment. Glucocorticoid, ciclosporin and antihistamine medications, and polyunsaturated fatty acid supplements, were all withdrawn for at least two months. The SCORFAD and FeDESI scores were calculated directly before skin hydration was measured, according to published methods.^{4,5} Cats were acclimatized to a room with a temperature ranging from 21 to 25°C and humidity of 41–60%. Hair was clipped if necessary with an electric shaver (0.3 mm blade) but not removed from hairless regions (internal side of the pinna) and when the examined area included self-induced alopecia. The measurements were collected from seven body sites: abdomen, axilla, groin, internal side of the left pinna, right forelimb, lumbar area and the left lateral side of the thorax, and performed on lesional areas. Skin hydration was measured with a Corneometer[®] CM 825, Courage Khazaka Multi Probe Adapter 5 (Courage 1 Khazaka electronic GmbH; Cologne, Germany) and the results were reported in AU (arbitrary units). Each measurement was collected three times and the mean of three recordings was used in the statistical analysis.

Statistical analysis

The average skin hydration from seven recordings was calculated for each cat. The results were verified for normality with the Shapiro–Wilk's test. The correlation between the total SCORFAD scores and the average skin hydration, and between the total SCORFAD scores and skin hydration for each of the body sites were calculated. The correlations between the total FeDESI scores and the average skin hydration, and between the total FeDESI scores and skin hydration on each of the examined body sites were calculated. The calculations were generated with the Spearman's test. Values of $P < 0.05$ were considered significant. All calculations were made with Statistica 10 software (StatSoft; Tulsa, OK, USA).

Results

Affected cats had SCORFAD scores ranging from 2 to 13 (median: 8) and FeDESI scores from 10 to 211 (median: 50.5). There was a positive correlation between the SCORFAD scores and the average skin hydration calculated from seven body sites ($r = 0.54$, $P = 0.02$). There

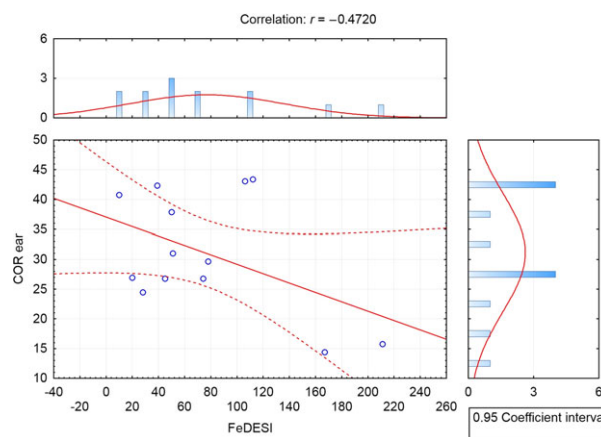


Figure 1. Correlation between Feline Extent and Severity Index (FeDESI) scores and corneometric skin hydration readings of the pinna body site (COR ear) for 18 cats.

were positive correlations between the SCORFAD scores and skin hydration for three of seven sites; axilla ($r = 0.5$, $P = 0.023$), thorax ($r = 0.46$, $P = 0.034$) and forelimb ($r = 0.47$, $P = 0.023$). There was no correlation between the SCORFAD scores and skin hydration for four of seven sites: abdomen ($r = 0.14$, $P = 0.31$), groin ($r = 0.09$, $P = 0.58$), pinna ($r = -0.12$, $P = 0.24$) and lumbar area ($r = 0.28$, $P = 0.46$).

There was no correlation between the FeDESI scores and the average skin hydration ($r = 0.14$, $P = 0.65$). For the FeDESI scores, there was a positive correlation for two of the seven sites: axilla ($r = 0.8$, $P = 0.001$) and the lumbar area ($r = 0.76$, $P = 0.002$). A negative correlation was recorded between FeDESI and skin hydration measured for the pinna ($r = -0.47$, $P = 0.02$) (Figure 1). There was no correlation between the FeDESI scores and skin hydration for four of seven sites: thorax ($r = 0.04$, $P = 0.16$), abdomen ($r = 0.01$, $P = 0.31$), groin ($r = -0.25$, $P = 0.31$) and forelimb ($r = -0.01$, $P = 0.33$).

Discussion

This study suggests that measurements of skin hydration of the lesional skin of atopic cats using corneometry may have a partial correlation with lesion severity when using two different clinical scoring systems. Positive correlation between the lesional severity of affected skin and hydration was recorded for six of seven body sites. Significant negative correlation between the FeDESI score and skin hydration was demonstrated only for the pinna.

In humans, skin hydration measurements are frequently used to evaluate the severity of atopic eczema.¹⁴ A decrease in skin hydration has been demonstrated from the lesional skin of atopic dogs, whereas skin hydration from the nonlesional skin of atopic dogs does not differ significantly from the skin of healthy dogs.¹⁰ This is in direct contrast to our results, where in the majority of cases there was an increase in hydration at the body sites investigated. It is difficult to explain why skin hydration (epidermal hydration) increases for some of the affected areas but it is presumed that at least for some body sites (e.g. axilla, abdomen or forelimb) this may be related to

pruritus-associated licking, which increases hydration of the epidermis. Exudation or oedema due to inflammation may also cause an increase in skin hydration.

A significant negative correlation between the FeDESI score and skin hydration was demonstrated only for the pinnal region from cats in this study. In humans, a negative correlation has been reported between the overall clinical scores and skin hydration; in our study this sort of relationship was only seen for the inside of the pinna.¹⁴ We speculate that this area is not licked by cats in the normal course of grooming or as a manifestation of pruritus and could explain why skin hydration in this region was decreased. This body region may be a suitable region for the assessment of skin barrier function in allergic cats.

Further studies are warranted to determine the usefulness of skin hydration measurements for the diagnosis and management of allergic skin disease in cats. The pinna may be a suitable body region for sampling.

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Supporting Information

Additional Supporting Information may be found in the online version of this article.

Table S1. Baseline characteristics of enrolled cats

Résumé

Contexte – L'évaluation de la sévérité des signes cliniques des chats atteints de maladies allergiques dermatologiques est basée sur deux méthodes de scoring : le SCORFAD (Scoring Feline Allergic Dermatitis) et le FeDESI (Feline Extent and Severity Index). L'intégrité de la barrière cutanée peut également être évaluée par la mesure de l'hydratation cutanée. Une corrélation entre le score clinique et l'hydratation cutanée a été observée chez l'homme et le chien atteint de dermatite atopique (DA).

Hypothèses – Démontrer une corrélation entre le score clinique et l'hydratation cutanée des chats présumés être atopiques.

Sujets – Des chats européen (n=18): 11 femelles et sept mâles avec une DA confirmée.

Méthodes – Les scores SCORFAD et FeDESI ont été calculés et les mesures de l'hydratation cutanée ont été réalisées sur sept zones du corps par corneométrie. La corrélation entre le SCORFAD, le FeDESI et l'hydratation cutanée de chaque site et l'hydratation cutanée moyenne a été calculée.

Résultats – Il y avait une corrélation positive entre le SCORFAD et l'hydratation cutanée pour les plis axillaires, le thorax et les membres antérieurs; pour le FeDESI et les plis axillaires et les lombes. Il y avait une corrélation négative entre le FeDESI et l'hydratation cutanée pour les pavillons auriculaires ($r = -0.47$).

Conclusions et importance clinique – Les mesures d'hydratation cutanée pourraient être un outil utile pour l'évaluation des chats allergiques. Il y a peu de preuve d'une quelconque corrélation utile entre les systèmes de scores cliniques et les mesures d'hydratation. Les pavillons auriculaires pourraient être une zone correcte pour l'évaluation de la fonction barrière cutanée chez le chat normal et allergique.

RESUMEN

Introducción – La evaluación de la severidad de los signos clínicos de gatos con enfermedades alérgicas de la piel ha utilizado dos sistemas de valoración: puntuación de dermatitis alérgica felina (SCORFAD) y el índice de severidad y extensión felina (FeDESI). La integridad de la barrera cutánea también puede

evaluarse midiendo la hidratación de la piel. Se ha observado una correlación entre la valoración clínica y la hidratación de la piel en humanos y perros con dermatitis atópica (EA).

Hipótesis – demostrar una correlación entre la valoración clínica y la hidratación de la piel de los gatos afectados con presunta AD.

Animales – gatos europeos de pelo corto ($n = 18$): 11 hembras y siete machos con diagnóstico confirmado de AD.

Métodos – se estimaron los resultados de SCORFAD y FeDESI y se obtuvieron mediciones de la hidratación de la piel en siete zonas del cuerpo utilizando corneometría. Se calculó la correlación entre los sistemas SCORFAD y FeDESI y la hidratación de la piel de cada zona elegida, así como la hidratación media de la piel.

Resultados – Hubo una correlación positiva entre la puntuación de SCORFAD y la hidratación de la piel para la axila, el tórax y el antebrazo; para FeDESI en axila y zonas lumbares. Hubo una correlación negativa entre el FeDESI y la hidratación de la piel del pabellón auricular ($r = -0,47$).

Conclusiones e importancia clínica – La medición de la hidratación de la piel podría ser una herramienta útil para la evaluación de gatos alérgicos. Hay poca evidencia de la existencia de correlación útil entre los sistemas de puntuación clínica y las mediciones de hidratación. El pabellón auricular puede ser una región adecuada para la evaluación de la función de barrera cutánea en gatos normales y alérgicos.

Zusammenfassung

Hintergrund – Eine Evaluierung der Schwere der klinischen Zeichen von Katzen mit allergischer Hauterkrankung, die zwei Bewertungssysteme verwendete: Scoring Feline Allergic Dermatitis (SCORFAD) und den Feline Extent and Severity Index (FeDESI). Die Integrität der kutanen Hautbarriere kann auch durch Messung der Hydratation der Haut gemessen werden. Eine Korrelation zwischen den klinischen Werten und der Skin Hydratation wurde beim Mensch wie beim Hund mit atopischer Dermatitis (AD) festgestellt.

Hypothese – Eine Demonstration der Korrelation zwischen den klinischen Werten und der Hydratation der Haut bei Katzen mit vermeintlicher AD.

Tiere – Europäische Kurzhaarkatzen ($n=18$): 11 weibliche und sieben männliche Tiere mit der bestätigten Diagnose einer AD.

Methoden – SCORFAD und FeDESI Werte wurden kalkuliert und die Messungen der Skin Hydratation wurden von sieben Körperstellen mittels Corneometrie erfasst. Die Korrelation zwischen SCORFAD und FeDESI Systemen und die Haut Hydratation einer jeden Körperstelle, sowie die durchschnittliche Hydratation der Haut wurden kalkuliert.

Ergebnisse – Es bestand eine positive Korrelation zwischen dem SCORFAD Wert und der Haut Hydratation für die Axillae, den Thorax und den Unterarm; für FeDESI und Axillae und Lumbalgegend. Es bestand eine negative Korrelation zwischen dem FeDESI und der Haut Hydratation der Pinna ($r = -0,47$).

Schlussfolgerungen und klinische Bedeutung – Messungen der Haut Hydratation könnten für die Evaluierung von allergischen Katzen nützlich sein. Es bestand eine limitierte Evidenz für sinnvolle Korrelationen zwischen den klinischen Bewertungssystemen und den Messungen der Hydratation. Die Pinna könnte eine nützliche Region für die Bewertung der Hautbarrierefunktion bei normalen wie allergischen Katzen sein.

要約

背景 – アレルギー性皮膚疾患を有する猫の臨床症状の重症度の評価には、猫アレルギー性皮膚炎スコアリング(SCORFAD)および猫の範囲および重症度指数(FeDESI)の2種類のスコアリングシステムが使用されてきた。皮膚バリアの完全性は、皮膚水和量を測定することによっても評価することができる。アトピー性皮膚炎(AD)を有する人および犬において、臨床スコアと皮膚水和量との相関が認められている。

仮説 – ADと仮診断された猫の臨床スコアと皮膚水和量との相関関係を実証すること。

供与動物 – ADと診断されたヨーロッパン・ショートヘア($n = 18$)の雌11頭と雄7頭。

方法 – SCORFADおよびFeDESIスコアを算出し、表皮角質水分量測定装置を用いて7箇所の身体部位の水和量を測定した。SCORFADあるいはFeDESIと各部位の皮膚水和量との相関および平均皮膚水和量を計算した。

結果 – 腋窩、胸郭および前腕のSCORFADスコアと皮膚水和量との間に正の相関があった。胸郭および腰部のFeDESIスコアと皮膚水和量との間にも正の相関があった。耳介のFeDESIと皮膚水和量との間には負の相関があった($r = -0.47$)。

結論および臨床的な重要性 – 皮膚の水分測定は、アレルギーのある猫の評価に有用なツールとなり得る。臨床スコアリングシステムと水分測定との間に有用な相関関係があることを示す証拠は限られていた。耳介は、正常およびアレルギーの猫における皮膚バリア機能の評価に適した部位であることが示唆された。

摘要

背景 — 使用两种评分系统:猫过敏性皮炎评分(SCORFAD)和猫程度和严重性指数(FeDESI),对过敏性皮肤病患猫临床症状的严重程度进行评估。通过测量皮肤水合状态,对皮肤屏障的完整性进行评估。在患有异位性皮炎(AD)的人和犬上发现,临床得分和皮肤水合状态之间存在相关性。

假设 — 揭示假定AD患猫临床得分与皮肤水合状态之间的相关性。

动物 — 确诊患有异位性皮炎(AD)的欧洲短毛猫($n=18$):11只雌性和7只雄性。

方法 — 计算SCORFAD和FeDESI得分,使用皮肤测量仪从7个不同的身体部位评估皮肤水合状态。计算SCORFAD和FeDESI系统与各部位皮肤水合状态,以及平均的皮肤水合状态之间的相关性。

结果 — 腋下、胸廓和前肢处的SCORFAD得分,以及腋下和腰部的FeDESI得分,与皮肤水合状态之间存在正相关,耳廓处的FeDESI得分与皮肤水合状态之间存在负相关($r = -0.47$)。

总结和临床意义 — 皮肤水合状态的测量是评估过敏症患猫的有效工具。目前有关临床评分系统与水合状态测量之间有价值的相关性资料十分有限,耳廓可能是一个合适的区域,用以评估正常猫和过敏症患猫的皮肤屏障功能。

Resumo

Contexto — A avaliação a severidade dos sinais clínicos de gatos com dermatopatias alérgicas tem sido feita por dois sistemas de escore: Scoring Feline Allergic Dermatitis (SCORFAD) e o Feline Extent and Severity Index (FeDESI). A integridade da barreira cutânea também pode ser avaliada pela mensuração da hidratação cutânea. A correlação entre o escore clínico e a hidratação da pele tem sido observada em humanos e cães com dermatite atópica (DA).

Hipótese — Demonstrar a correlação entre os escores clínicos e a hidratação da pele de gatos afetados supostamente por DA.

Animais — Gatos europeus de pelo curto ($n = 18$): 11 fêmeas e sete machos com diagnóstico de DA confirmado.

Métodos — Os escores SCORFAD e FeDESI foram calculados e a mensuração da hidratação cutânea foi feita por avaliação de sete áreas corpóreas, com um corneômetro. A correlação entre os sistemas SCORFAD e FeDESI e a hidratação de cada área, e a média da hidratação cutânea foram calculadas.

Resultados — Houve uma correlação positiva entre o escore SCOFAD e hidratação para axila, tórax e antebraço; e entre o FeDESI e axila e região lombar. Houve uma correlação negativa entre FeDESI e a hidratação da pele do pavilhão auricular ($r = -0.47$).

Conclusões e importância clínica — A mensuração da hidratação da pele pode ser uma ferramenta útil na avaliação de gatos alérgicos. Há limitadas evidências da utilidade da correlação entre os sistemas de escore clínicos e mensuração da hidratação. O pavilhão auricular pode ser uma região adequada para a avaliação da função da barreira cutânea em gatos normais e alérgicos.

Supporting Information Table S1

Baseline characteristics of enrolled cats

FeDESI score	SCORFAD score	Average skin hydration*	Age	Sex	Onset of disease (age)	Clinical presentation
106	10	10.24	5	♀	2 weeks before presentation	P, MD, A
167	10	14.01	3	♀	2 months before presentation	P, EP, A
211	12	17.4	2	♀	1 month before presentation	P, A, MD, EP
75	7	7.73	2	♂	1	A, P
51	12	28.53	3	♀(spayed)	3	P, A, EP, MD
21	7	14.11	3	♀ (spayed)	2.5	P, A, EP
20	3	11.78	6	♂	3	P, A, MD
28	7	8.49	7	♀ (spayed)	4	P, MD
39	9	18.47	5	♂	2	P, A, EP
21	4	3.57	7	♀	3	
78	11	24.24	3.5	♂	1 month before presentation	P, A, MD
74	8	14.41	3.5	♀	3	P, A, MD
10	2	9.09	3.5	♂	2.5	P, A
11	5	9.9	4	♀ (spayed)	3	P, A
45	8	12.89	5.5	♀ (spayed)	2	P, A
132	13	12.86	6	♂	1 month before presentation	P, A, EP, MD
112	12	10.93	5	♂	1 month before presentation	P, A, MD, EP
50	8	8.73	3	♀	1.5	P, A

Abbreviations A – alopecia; EP – Eosinophilic plaque; FeDESI Feline Extent and Severity Index; MD - miliary dermatitis; P – pruritus; SCORFAD Scoring Feline Allergic Dermatitis; * Hydration was measured in arbitrary units