Experimental evaluation of photo-protective activity of ultraviolet protective products in veterinary medicine

C. COUTEAU[1,3], P. BOURDEAU[2,3], V. BRUET[2, 3], L. COIFFARD[1, 3]

[1] University of Nantes, LUNAM University, LPIC, MMS, EA2160, Faculty of Pharmacy, 9 rue Bias – Nantes, F-44000 France

[2] Dermatology/Parasitology/Mycology Unit, Oniris, LUNAM University, Nantes, France

[3] CRESIP (Universitary Hospital Center 44093 NANTES

Résumé :

Le rayonnement solaire peut être la cause de photodermatites, particulièrement chez le chien et le cheval. Leur prévention, peut faire appel à des produits de protection solaire. Actuellement, il n'existe que très peu d'informations sur la réelle efficacité des produits apparus récemment sur le marché. Le but de ce travail est l'étude *in vitro* de quelques produits du commerce par calcul de leur Sun Protection Factor (SPF). La méthode utilisée est basée sur la détermination de la transmittance, à l'aide d'un spectrophotomètre équipé d'une sphère d'intégration, après application du produit à tester sur une plaque en polymétacrylate de méthyle. Six préparations topiques ont été testées : 4 crèmes, 1 stick et 1 lingette affichant des indices de protection de 15 à 30. Ces produits sont formulés à l'aide de filtres organiques (octylméthoxycinnamate, benzophénones) et/ou un filtre minéral, le dioxyde de titane (TiO_2). Les résultats montrent que seul l'Ecran solaire chien chat® SPF 30+ (Dermoscent) offre réellement un niveau de protection (SPF *in vitro* de 29,30). L'un des autres (Doggy sunwipes® SPF 15) offre un niveau de photo-protection faible (SPF voisin de 6) inférieur à celui annoncé (15). Les autres produits testés s'avèrent totalement dénués d'effet protecteur (valeurs trouvées comprises entre 1 et 2). Il est donc nécessaire de valider l'efficacité des produits de protection solaire destines aux animaux comme c'est le cas pour ceux destinés à l'homme.

Summary:

Actinic and photo-aggravated dermatoses have been described in domestic species, particularly in dogs and horses. Their control and prevention include the use of Ultraviolet (UV) protective screens. Very little information if any is available on the real effectiveness of products launched or used in veterinary medicine. The aim of the study was to evaluate the real UV protective index (SFP) using an *in vitro* method based on the transmittance measurement carried out using a spectrophotometer equipped with integrating sphere after spreading of products tested on polymethylmetacrylate plates.

Six topical preparations were tested: creams (4), stick (1) and wipe (1) with announced protective index ranging from 15 to 30 for 4 of them and containing organic filters (octylmethoxycinnamate, benzophenones) and or inorganic titanium dioxide (TiO_2). The results show that only one product Ecran solaire chien chat® SPF 30+ (Dermoscent) really afford experimentally the claimed protective index (SPF determined in vitro is equal to 29.30). Another product Doggy sunwipes® SPF 15 shows a low activity (SPF close to 6) instead of announced 15, finally the 4 other products are completely devoid of any UV protective effect (values obtained between 1 and 2). The authors conclude in the necessary improvement of validation of photo-protective products used in veterinary medicine similarly to the procedures used for humans.

Introduction:

In dogs and horses, solar dermatitis is caused by direct UV injury to skin cells, with severity related to duration and intensity of sun exposure. Solar dermatitis frequently occurs on the muzzle, although any poorly pigmented or unpigmented skin with prolonged sun exposure is predisposed (Albanese et al., 2013). For pets who spend ample time outdoors, it is also possible to use sunscreens which blocks the sun's rays. But which is the real efficiency of such products?

Aims of the study:

The aim of the study was to evaluate the real UV protective index (SFP) of six sunscreens using an *in vitro* method.

Materials and Methods:

We tested 6 products launched for an veterinary used.
The list of products includes 4 creams, 1 stick, and 1 wipe – all claiming an SPF between 15 and 30 (Table1).

Table 1: Characteristics of products tested

Product tested	Protection factor labelled
Ecran solaire chien chat Dermoscent	30+
Hoher Schutz	30
Quic screen	none
Men for san	none
Doggy sun stick	15
Doggy sunwipes	15

Polymethylmethacrylate (PMMA) plates were purchased from Europlast (Aubervilliers, France). A previous study has described the protocol (Couteau et al., 2007). Thirty mg of precisely weighed product were spread across the entire surface (25 cm^2) of a polymethylmethacrylate (PMMA) plate using a cot-coated finger (Figure 1). After spreading, 15 mg of the product remained on the finger cot. SPF of the products were measured *in vitro*. Three plates were prepared for each product to be tested and 9 measurements were taken from each plate. Transmission measurements between 290 and 400 nm were taken using a spectrophotometer equipped with an integrating sphere (UV Transmittance Analyzer UV1000S, Labsphere, North Sutton, US) (Figure 2).

Figure 1: Spraying technique

The calculations use the following equation:

$$SPF = \frac{\sum_{290}^{400} E_\lambda S_\lambda \Delta\lambda}{\sum_{290}^{400} E_\lambda S_\lambda T_\lambda \Delta\lambda}$$

where E_l is CIE erythemal spectral effectiveness, S_l is solar spectral irradiance and T_l is spectral transmittance of the sample (Diffey & Robson, 1989).

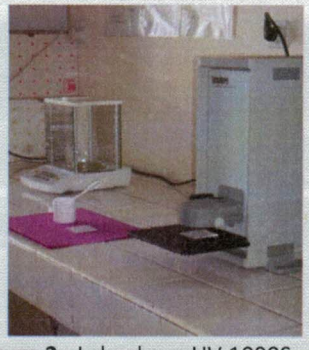

Figure 2 : Labsphere UV 1000S

Results and Discussion :

The results obtained are presented in Table 2.

Product tested	SPF measured *in vitro*
Ecran solaire chien chat Dermoscent	29.30 ± 2.45
Hoher Schutz	1.20 ± 0.04
Quic screen	1.83 ± 0.03
Men for san	1.51 ± 0.02
Doggy sun stick	1.28 ± 0.02
Doggy sunwipes	5.91 ± 0.44

Table 2: Results obtained with the pet sunscreens tested

Only the product Ecran solaire chien chat® SPF 30+ (Dermoscent) really offers the claimed protective index. The product Doggy sunwipes® SPF 15 shows a low activity (SPF close to 6) instead of 15. The 4 other products are completely devoid of any UV protective effect.). The authors conclude in the necessary improvement of validation of photo-protective products used in veterinary medicine .

References : - Albanese, F., Abramo, F., Caporali, C. Clinical outcome and cyclo-oxygenase-2 expression in five dogs with solar dermatitis/ actinic keratosis treated with firocoxib. *Vet. Dermatol.* **2013**, 24: 606-e147.
- Couteau, C., Pommier, M., Paparis, E., Coiffard, LJ. Study of the efficacy of the 18 sun filters authorized in european Union tested in vitro. *Pharmazie* **2007**, 62 (6):449-452.
- Diffey, BL., Robson, J. Sun Protection Factor in vitro. *J. Soc. Cosmet. Chem.* **1989**, 40, 127-133.

Original Self-funded