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Original article

Influence of hair clipping on transepidermal water loss values in horses: a pilot study

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Abstract

The measurement of transepidermal water loss (TEWL) is one of the biophysical skin parameters used to assess skin barrier function. Assessment of transepidermal water loss, may depend on such factors as body region, age, sex or breed and the hair coat has been considered as one of the factors that may cause variation of TEWL values. The aim of our research was an examination of the influence of clipping on the amount of TEWL. The examination was performed with 12 Wielkopolska horses with Courage Khazaka Multi Probe Adapter 5 and a TEWL TM 300 probe. The TEWL values were statistically constant in the clipped site, while the values in the unclipped sites were not. Hair clipping of examined sites is recommended for TEWL measurement in horses.

Key words: horses, transepidermal water loss, clipping

Introduction

Non-invasive methods used commonly in the process of assessing skin condition include the examination of a number of biophysical skin parameters such as transepidermal water loss (TEWL), skin hydration (SH), skin pH and erythema intensity as revealed in the literature (Beco and Fontaine 2000, Hester et al. 2004, Shimada et al. 2009, Szczepanik et al. 2011, Szczepanik et al. 2012, Szczepanik et al. 2013). Biophysical skin parameters (TEWL, SH, skin pH) have been assessed in dogs, cats, horses and laboratory animals (Matousek and Campbell 2002, Popiel and Nicpoń 2004, Fluhr et al. 2006, Gołyński et al. 2014, Szczepanik et al. 2016, Yoshihara et al. 2007). The first of the mentioned methods, TEWL, is most commonly used and considered as the most accurate assessment of epidermal damage and Shimada et al. (2008) have shown that this is also a good parameter to evaluate skin barrier functions correlating well with the degree of lesions assessed clinically and histopathologically. This biophysical parameter of skin describes the amount of water lost through the skin and is an index for possible damage to the skin barrier. TEWL has been most commonly used and applied to healthy dogs, cats and horses (Beco and Fontaine 2000, Hester et al. 2004, Momota et al. 2016, Szczepanik et al. 2016) and is also described in feline and canine patients with atopic dermatitis (Shimada et al. 2008, Cornegiliani et al. 2013, Zając et al. 2014).

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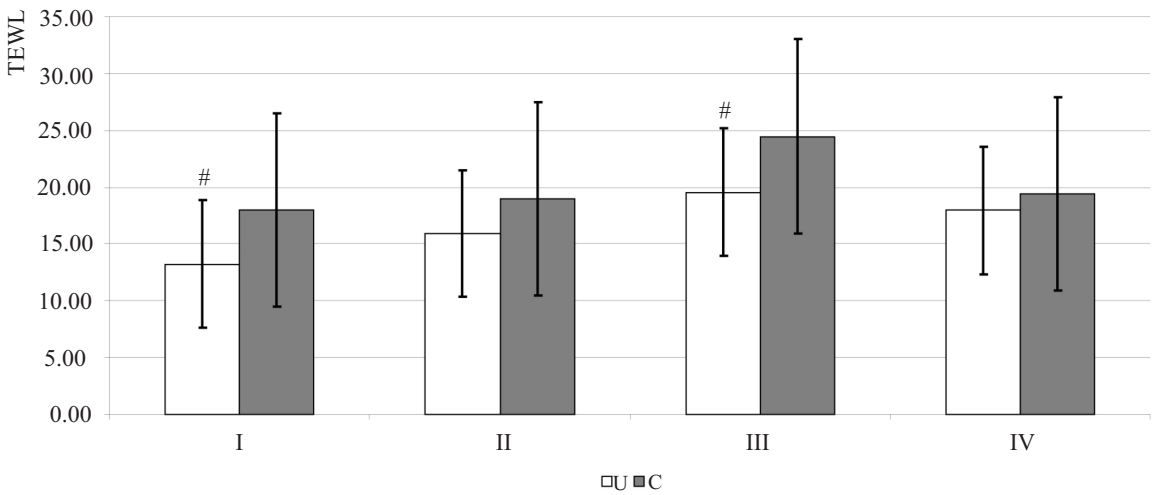

Fig. 1. Transepidermal water loss (TEWL) (g/m^2 h) in clipped (C) and unclipped (U) site I, II, III, IV, – T0, T1, T2 , T3; # – statistically significant difference.

Table 1. Transepidermal water loss (TEWL) (g/m^2 h) in clipped and unclipped site.

	T0		T1		T2		T3	
	unclipped	clipped	unclipped	clipped	unclipped	clipped	unclipped	clipped
Mean TEWL (g/m^2 h)	13.14#	18.02	15.92	18.97	19.56#	24.47	17.95	19.44
Standard deviation	5.58	8.52	6.54	8.88	7.52	11.73	10.41	12.09

– statistically significant difference; T0 – 2 minutes after clipping, T1 – after one hour, T2 – after four hours, T3 – after 24 hours.

TEWL may depend (Beco and Fontaine 2000, Szczepanik et al. 2011, Momota et al. 2013, Szczepanik et al. 2016) on such factors as body region, age, sex or breed and the hair coat has been considered as one of the factors that may cause variation of TEWL values. The assessment of transepidermal water loss in animals has been performed after different types of skin preparation (unclipped or clipped with different methods using scissors or an electric clipper). There have been no studies so far investigating the influence of clipping on the results in horses. Therefore, the aim of our research was an examination of the influence of clipping on the results of TEWL in selecting a more reliable method, characterised by a smaller variability of results.

Materials and Methods

The examination was performed with 12 Wielkopolska horses, aged 4-30 (median 6), 4 males (including 1 castrated male) and 8 females. The animals were clinically healthy at the time of the examination and had no history of skin disease. They were acclimatised in the test room at least 120 minutes prior to the measurement. The temperature in the room was 24 +/- 2^{o}C, with a humidity of 55 +/- 5%. TEWL was measured on two sites: the side of the thorax after and without clipping with scissors (ca. 1-2 cm^2). For each of the horses 10 measurements were taken, both on clipped and unclipped skin, and subsequently the mean result was calculated and used to statistical analisis. The measurement began after about 30 seconds' contact of the probe with the skin, and lasted about 30 seconds. Four measurements were taken: at T0, after one hour (T1), after four hours (T2) and after 24 hours (T3). In the case of the clipped sites T0 measurement was taken about 2 minutes after clipping. TEWL assessment was performed with a Courage Khazaka Multi Probe Adapter 5 and a: Tewameter TM 300 TEWL probe (Courage Khazaka, Cologne, Germany) (results in g/m^2 h).

Statistical analysis

The mean result and the standard deviation were calculated for the 12 animals both for the measurements taken on unclipped skin (U) and clipped skin (C). Finally, t-test was performed to determine

whether the differences between the results were statistically significant (p=0.05).

Results

There were no statistically significant differences between measurements results for clipped and unclipped sites at various time intervals (results at T0, T1, T2 and T3 did not differ on clipped and unclipped skin). As regards changes in measurement results in time, no statistically significant differences between the results were reported for clipped skin. As far as unclipped skin is concerned, there was a statistically significant increase in TEWL value after measurement at T2 (after 4 hours), and the results was statistically significantly different from the result at T0. The results are presented in Fig. 1.

Discussion

The assessment of TEWL in animals has recently been the subject of numerous studies (Hester et al. 2004, Lau-Gillard et al. 2010, Szczepanik et al. 2011, Szczepanik et al. 2016), where it has been examined in different body regions of several animal species. The assessment of transepidermal water loss in animals has been performed after different types of skin preparation. In dogs, measurements have been taken on skin with clipped and unclipped hair by Lau-Gillard et al. (2010) and Oh and Oh (2009). Oh and Oh (2009) have shown that in dogs clipping itself can affect measurement value, while Lau-Gillard et al. (2010) (in dogs also) have not reported such an effect. Szczepanik et al. (2011) provided measurements in cats taken after hair clipping, and also both after and without it (Szczepanik et al. 2013). There have been no studies so far investigating the influence of clipping on the results in horses, and in the studies published so far hair clipping was used by Szczepanik et al. (2016). Momota et al. (2013) investigated the influence of different clipping methods on the obtained results and found that (in cats) measurements taken on clipped sites were more reliable. In this case the variability of results in time is smaller than in the case of unclipped skin, as in our research. In conclusion, the present study demonstrated that TEWL values were statistically constant in the clipped site in the thorax, while TEWL values in the unclipped site were not. Hair clipping of measurement sites helps to minimize the variation in TEWL measurement. In view of the above results, we recommended that measurements of TEWL should be performed on clipped skin which is less likely to yield variable results.

References

Beco L, Fontaine J (**2000**) Corneometry and transepidermal water loss measurements in the canine species: validation of these techniques in normal beagle dogs. Ann Med Vet 144: 329-333.

Cornegiliani L, Vercelli A, Noli C (**2013**) Trans epidermal water loss in healthy and cats with skin allergy. Veterinaria (Cremona) 27: 37-40.

Fluhr JW, Feingold KR, Elias PM (**2006**) Transepidermal water loss reflects permeability barrier status: validation in human and rodent in vivo and ex vivo models. Exp Dermatol 15: 483-492.

Gołyński M, Szczepanik M, Lutnicki K, Adamek Ł, Gołyńska M, Wilkołek P, Sitkowski W, Kurek Ł, Dębiak P (**2014**) Biophysical parameters of rats' skin after the administration of methimazole. Bull Vet Inst Pulawy 58: 315-319.

Hester SL, Rees CA, Kennis RA, Zoran DL, Bigley KE, Wright AS, Kirby NA, Bauer JE (**2004**) Evaluation of corneometry (skin hydration) and transepidermal water-loss measurements in two canine breeds. J Nutr 134: 2110S-2113S

Lau-Gillard PJ, Hill PB, Chesney CJ, Budleigh C, Immonen A (**2010**) Evaluation of hand-held evaporimetr (VapoMeter) for the measurement of transepidermal water loss in healthy dogs. Vet Dermatol 21: 136-145.

Matousek JL, Campbell KL (**2002**) Comparative review of cutaneous pH. Vet Dermatol 13: 293-300.

Momota Y, Shimada K, Noguchi A, Saito A, Nozawa S, Niina A, Tani K, Azakami D, Ishioka K, Sako T (**2016**) The modifed corneocyte surface area measurement as an index of epidermal barrier properities: inverse correlation with transepidermal water loss. Vet Dermatol 27: 67-e19.

Momota Y, Shimada K, Takami A, Akaogi H, Takasaki M, Mimura K, Azakami D, Ishioka K, Nakamura Y, Sako T (**2013**) Transepidermal water loss in cats: comparision of three differently clipped sites to assess the influence of hair coat on transepidermal water loss values. Vet Dermatol 24: 450-452.

Oh WS, Oh TH (**2009**) Measurement of transepidermal water loss from clipped and unclipeped anatomical sites on the dog. Austr Vet J 87: 409-412.

Popiel J, Nicpoń J (**2004**) The correlation of a skin pH of dogs with the pyoderm treatment before and after usage of surface-acting agents of known pH reaction. Acta Sci Pol Medicina Veterinaria 3: 53-60.

Shimada K, Yoon J, Yoshihara T, Iwasaki T, Nishifuji K (**2009**) Increased transepidermal water loss and decreased ceramide content in lesional and non-lesional skin of dogs with atopic dermatitis. Vet Dermatol 20: 541-546.

Shimada K, Yoshihara T, Yamamoto M, Konno K, Momoi Y, Nishifuji K Iwasaki T (**2008**) Transepidermal water loss (TEWL) reflects skin barrier function of dogs. J Vet Med Sci 70: 841-843.

Szczepanik MP, Wilkołek PM, Adamek ŁR, Pomorski ZJ (**2011**) The examination of biophysical parameters of skin (transepidermal water loss, skin hydration and pH value) in different body regions of normal cats of both sexes. J Feline Med Surg 13: 224-230.

Szczepanik MP, Wilkołek PM, Pluta M, Adamek ŁM, Pomorski ZJ (**2012**) The examination of biophysical par-

ameters of skin (transepidermal water loss, skin hydration and pH value) in different body regions of ponies. Pol J Vet Sci 15: 553-559.

Szczepanik MP, Wilkolek PM, Pluta M, Adamek ŁR, Golynski M, Pomorski ZJ, Sitkowski W (**2013**) The examination of biophysical skin parameters (transepidermal water loss, skin hydration and pH value) in different body regions in Polish ponies. Pol J Vet Sci 16: 741-747.

Szczepanik MP, Wilkołek PM, Adamek ŁR, Pluta M, Gołyński M, Sitkowski W, Kalisz G, Taszkun I, Pomorski ZJ (**2016**) Influence of horse breed on transepidermal water loss. Pol J Vet Sci 19: 859-864.

Yoshihara T, Shimada K, Momoi Y, Konno K, Iwasaki T (**2007**) A new method of measuring transepidermal water loss (TEWL) of dogs skin. J Vet Med Sci 69: 289-292.

Zając M, Szczepanik MP, Wilkołek PM, Adamek ŁR, Pomorski ZJ, Sitkowski W, Gołyński M. (**2014**) Assessment of the relationship between transepidermal water loss (TEWL) and severity of clinical signs (CADESI-03) in atopic dogs. Vet Dermatol 25: 503-506.