ASSESSMENT OF SKINFOLD THICKNESS AS A FACTOR RELATED TO CHRONIC PROGRESSIVE LYMPHOEDEMA IN BELGIAN DRAUGHT HORSES

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INTRODUCTION

For decades, disfigurement of the lower limbs has been present in the Belgian draught horse population. However, only in 2003 the term chronic progressive lymphoedema (CPL) was assigned to this condition, also seen in other heavy feathered draught horse breeds as Shire and Clydesdale (De Cock *et al.,* 2003). Although the exact cause is not yet identified, it is primarily a disorder of the lymph system and the skin elastic network (De Cock et al., 2006a); De Cock *et al.,* 2006b). Clinical symptoms start at early age and mostly deteriorate through life, often ending with severe disability which frequently justifies euthanasia (De Cock *et al.,* 2003, Ferraro 2003). Clinical signs are highly variable and CPL progression is unpredictable. Initially, the lower limbs present increasing skin thickness and hyperkeratosis, with one or two skinfolds predominantly in the rear pastern region. Progressively, enlargement becomes firm and is associated with lesions wich can affect the entire lower limb(s): (thick) skinfolds, marked dermatitis, scaling, nodular fibrosis and ulcerations (De Cock *et al.,* 2009). Clinical signs and dermatological changes show great resemblance to human chronic lymphoedema (Harwood and Mortimer, 1995; De Cock *et al.,* 2003). Treatment will only slow down the formation or progression of lesions. Skin biopts of affected draught horses show dermal anomalies, both in distal limb and neck compared to non affected breeds, which demonstrates that CPL is a generalised disease with major skin alterations (De Cock *et al.,* 2006a; De Cock *et al.,* 2009). Prominence of anatomical structures as fetlock tufts of hairs and factors as age and sex are related to the severity of CPL skin lesions (De Cock *et al.,* 2003; Geburek *et al.,* 2005).
Although skinfold thickness is mostly used as an indicator of fat content (Durnin *et al.,* 1996; Garcia *et al.,* 2010), ultrasonic skin thickness measurements were diagnostic in breast lymphoedema in women (Libshitz *et al.,* 1977; Mellor *et al.,* 2004). Dermal thickness and clinical skin presentation are also correlated in other disorders involving oedema (systemic sclerosis) (Daloudi *et al.,* 2009). Using a skinfold caliper, it was possible to detect changes in axillary skinfold lymphoedema following breast cancer treatment (Roberts *et al.*, 1995). Clinical examination is the most practical way to diagnose CPL in draught horses. Other factors could confirm this method and subsequently objectify diagnosis. Therefore this study aims to assess the possible relationship between skinfold thickness (neck) and sex, age and clinical CPL condition.

MATERIAL AND METHODS

Animals

555 privately owned Belgian draught horses were examined on official horse inspections (11) and stable visits (27) in Belgium, during 1 year (october 2009-2010). All animals were in good health, except for those animals with skin lesions associated with CPL.

Data collection

Skinfold thickness (449 of 555 Belgian draught horses) was measured with a Harpenden Skinfold Caliper (Baty International, Sussex, UK) at the left side of the neck (1 hand at the front side of the scapula, 1 hand above the neck vertebrae). The skin was picked up between thumb and forefinger and pulled away slightly from the underlying tissue. Caliper jaws were placed perpendicular to the neck and about 5mm distance from the end of the skinfold. Reading was taken after a few seconds (thumb and forefinger removed). This measurment was repeated 3 times for each horse.

Veterinary examination included an inspection and firm palpation of the 4 limbs (536 of 555 Belgian draught horses), beginning at the level of the knee/hock, gradually moving down to the hoofs. Skin lesions were scored by means of a a formulated veterinary scoring system, which divides the animals into 5 groups (Table 1). Classification was based on clinical extensiveness of CPL lesions, with the fetlock joint as imaginary boundary. Animal information (studbook number and date of birth) was kindly provided by the Royal Belgian draught horse studbook.

Table 1. Veterinary scoring system which classifies horses of CPL affected breeds in 5 groups according to clinical presentation (affected region based on fetlock joint as imaginary boundary)

Score	Class	Lesions	Affected region
1	No	No	No
2	Mild	Light swelling limb(s) One/two skinfolds RPR[1]	Under FL[2]
3	Moderate	Perceptible swelling limbs Several skinfolds (+nodules) RPR[1]	Including FL[2]
4	Severe	Severe swelling limbs Several thick skinfolds+nodules RPR[1] (+dorsal)	Above FL[2]
5	Extreme	=4, +dorsal lesions, impaired movement, bad odour, exsudate	Above FL[2]

[1]Rear pastern region
[2]Fetlock joint

Statistical analysis

Veterinary scores (1 per limb, 4 per animal) were converted into a total CPL score per animal and log transformed. All statistical analysis were performed using a general linear model, including age, sex and skinfold thickness (SAS9.2) with statistical significance set at 0.05.

RESULTS AND DISCUSSION

Skinfold thickness and CPL lesions

Skinfold thickness values of male Belgian draught horses were higher compared to females (respectively 8.0±1.3cm and 5.2±0.9cm) (Table 2), which is in accordance to literature (Greenwood, 1966; Martin *et al.*, 1992). Skinfold measurement at the level of the limbs using a skinfold caliper is not executable due to the lesions of CPL affected horses and the firm attachement of healthy skin to underliyng tissues. In oedema following breast cancer treatment, modified skinfold calipers were able to detect axillary skinfold oedema (Roberts *et al.,* 1995). Since skin changes in clinically healthy CPL affected horse breeds show similar anomalies both in neck and pastern skin biopts (De Cock *et al.,* 2006), we prefered measuring neck skinfolds.

Table 2. Mean skinfold thickness, age and CPL score in Belgian draught horses

	Males			Females		
	N	**Mean**	**SEM[1]**	**N**	**Mean**	**SEM[1]**
Age (yrs)	134	3.504	2.346	421	4.519	3.283
Min_age (yrs)	134	0.348		421	0.331	
Max_age (yrs)	134	13.268		421	17.312	
CPL_LF[2]	128	2.086	1.157	414	1.983	1.09
CPL_RF[2]	128	2.086	1.157	414	1.990	1.20
CPL_LH[2]	125	2.288	1.281	411	2.156	1.19
CPL_RH[2]	125	2.328	1.268	411	2.170	1.19
CPL_Total[3]	125	8.776	4.773	411	8.31	4.44
logCPL_Total[3]	125	0.943	0.678	411	0.920	0.648
Skin[4]	104	8.0	1.3	345	5.2	0.9

[1]SEM: standard error of mean
[2]CPL score LF (front limb left), RF (front limb right), LH (hind limb left), RH (hind limb right)
[3] Total CPL score, mean of four limbs
[4]Skinfold thickness (mean of 3 measurements)

Table 3. Estimated log (CPL) total and P values as related to age, sex and skinfold thickness in 431 Belgian draught horses

Parameter	**Estimated log (CPL total)**	**P value**
Mean log CPL	2.045	
Age stallion	0.147	<0.05
Age mare	0.090	<0.05
Sex	-0.134	0.24
Skinfold thickness	0.056	0.0053
Age*sex stallion	0.147	<0.05
Age*sex mare	0.0897	<0.05

A significant association between age and total CPL score was detected (P<0.001) and this relationship is different for both sexes (Table 3). There is a significant interaction between sex and age (P<0.0001) and males tend to develop CPL lesions quicker compared to females. Stallions are mostly larger and heavier compared to mares. Increasing cannon bone circumference and

prominent fetlock tufts of hair are significantly correlated to the severity of skin lesions (Geburek *et al.,* 2005). Possibly, heavily feathered and larger horses (predominantly stallions), are more sensitive to develop CPL associated clinical symptoms.
A linear model including age and sex results in a significant (P=0.0053) (Table 3) association between skinfold thickness and total CPL scores. The possibility to measure differences in skinfold thickness in lymphoedematous subjects, confirms the results of an earlier study in humans

CONCLUSION

There is a significant relationship between skinfold thickness on the one hand and total CPL scores and age (sex dependent) on the other hand.

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