

Aloe vera-based formula as emollient on horses' hooves¹

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ABSTRACT

The present study aimed at developing an *Aloe vera*-based formula for topical use on horse hoof and evaluating whether the treatment affects hooves growth and balance. Six healthy male horses between the ages of 3 and 17 years (12 ± 5.25) were used, all semi-confined animals for breeding purposes. Before beginning *A. vera* treatment, animals underwent two trimming procedures with a 45 days-interval. After the second trimming, one of the forelimbs and one of the hindlimbs of 4 horses was weekly treated by topical application of the glycolic extract of *A. vera* at 20%. The contralateral limb, randomly chosen, received the extract at 50%. The hooves of the other animals were treated with propylene glycol. Treatment was done for 225 days and, during this time, animals underwent periodic trimming. Variables related to growth and balance of the hooves were measured before and after trimming. Data were analyzed using chi-square test and regression analysis at 5% significance. Growth rate of the hooves was not related to treatment. On the other hand, the 50% extract was related to the majority of the hooves in balance ($p < 0.05$). Results suggest that a weekly topical treatment with *A. vera* glycolic extract does not improve the growth rate of the hooves; however, when applied at a high concentration, it improves their balance.

Key words: equine, trimming, phytotherapy.

RESUMO

Formulação à base de *Aloe vera* para aplicação como emoliente em casco de cavalos

O objetivo deste estudo foi desenvolver uma formulação à base de *Aloe vera* para uso tópico em casco de cavalos, e avaliar se existe efeito do tratamento no crescimento e equilíbrio dos cascos. Foram utilizados seis cavalos hígidos, machos, com idade entre três e 17 anos ($12 \pm 5,25$), usados para reprodução e mantidos em regime de semiconfinamento. Antes de iniciar o tratamento com *A. vera*, os animais foram submetidos a dois casqueamentos, com intervalo de 45 dias. Após o segundo casqueamento, um dos cascos dos membros torácicos e pélvicos de quatro cavalos foi semanalmente tratado, por via tópica, com o extrato glicólico de *A. vera*, a 20%. O membro contralateral recebeu o extrato a 50%, sendo a escolha ao acaso. Os cascos dos outros dois animais foram tratados apenas com propilenoglicol. O tratamento foi efetuado durante 225 dias e, nesse período, os animais foram submetidos a casqueamentos periódicos. As variáveis relacionadas com o crescimento e equilíbrio dos cascos foram mensuradas antes e após cada casqueamento. Os dados foram analisados pelo teste qui-quadrado e pela análise de regressão a 5% de significância. A taxa de crescimento dos

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cascos foi independente do tratamento realizado. Por outro lado, o extrato da planta a 50% esteve associado ($p < 0,05$) ao maior número de cascos em equilíbrio. Os resultados obtidos sugerem que o tratamento tópico semanal com extrato glicólico de *A. vera* não melhora a taxa de crescimento do casco, mas quando aplicado em alta concentração resulta em melhoria do seu equilíbrio.

Palavras-chave: equinos, casqueamento, fitoterapia.

INTRODUCTION

The horse hoof is a structure surrounding the distal phalanx, formed by epithelial keratinization. It protects adjacent structures, initiates the dispersion of concussive forces and reduces vibrations generated during the contact of the limb with the ground (Dyhre-Poulsen *et al.*, 1994). It's grows throughout the life of the horse (Pollitt, 1998), occurring at an approximate rate of 6 mm a month and taking from 9 to 12 months for complete renewal (Stashak, 2002).

For Eustace (1994), four factors influence the quality of horses hooves: heredity, feed, handling and farriery. Good quality hooves are able to resist more easily to environmental changes. However, low quality ones are susceptible to a variety of problems. Therefore, hooves care may one of the determinant factors on the animal's performance of the intended functions. A healthy hoof, adequately moistened, absorbs impact from the ground much more efficiently than a dry hoof. Every healthy hoof has a thin shiny cover of a material that covers its walls (external layer). The function of such substance is to delay humidity evaporation, a fundamental aspect for maintaining their hydration. The external layer (*stratum externum*) is lost during shoeing when hooves walls undergo trimming, leading to an increase in moisture loss and, consequently, their dryness (Fitovet, 2009), resulting in excessive flaking and cracking (McClure *et al.*, 1975; Fitovet, 2009). In this case, good moisture is important to prevent such excessive dryness.

Medicine has been using *Aloe vera*, popularly known as Barbados Aloe or First Aid Plant, as ointment for the treatment of radiation burns and for the repair of wounds, contusions and irritation. The extract of the leaves is indicated as a tonic, as a purgative and for jaundice. The sticky dried juice from the leaves serves as an emollient ingredient (skin softener) in many lotions, creams, ointments and shampoos, largely applied in domestic usage and in pharmaceutical products (Reynolds & Dweck, 1999).

So far, no reports have been found using *Aloe vera* for the skin of horses. Dal'Belo *et al.* (2006) evaluated the effect of hydrating cosmetic formulations in humans containing different concentrations of the lyophilized gel of *A. vera*. This study revealed that only the formulas with high concentrations (0.25 and 0.5% w/w) increased the amount of water in the cornified layer of the skin after only one application. When applied twice a day for two weeks, all formulas containing 0.1, 0.25 e 0.5% w/w of the powder *A. vera* gel had the same effect. However, transepidermal water loss was not different with the inclusion of *A. vera* gel in the formulas when comparing to the vehicle. According to the authors, moisture improvement was possibly due to an emollient mechanism.

The objective of the present work was to develop an *Aloe vera*-based formula for horses' hooves, as well as to investigate the plants effect on hooves growth and balance.

MATERIALS AND METHODS

The present work has been approved by the Ethics Committee of the Departamento de Veterinária at the Universidade Federal de Viçosa (DVT/UFV), Protocol No 49/2010. The procedures were conducted according to the DVT/UFV Guidelines of Conduct for the Use of Animals in Education, Research and Extension, with the Veterinarian Ethics Professional Code and with ethical principles established by the Brazilian College on Animal Experimentation and the actual Brazilian legislation.

Animal's selection and general handling

Six stallions were used: three Mangalarga Marchador, two Breton and one Arabian. Their age varied between 3 and 17 years (12 ± 5.25) and weight between 310 and 463 kg (370.50 ± 65.89). During animals selection, general physical examination was carried out [heart rate (HR), respiratory rate (RR), capillary refill time, body temperature, mucous membrane color, degree of hydration and intesti-

nal motility] (Wilson & Gordon, 1987), and specific static and dynamic examination of the locomotor system, including only healthy horses (Stashak, 2002).

Animals were used for breeding, mainly semen donors, kept in semi-confinement with daily access to paddocks or stockyard for six hours. The forage in the paddocks was formed by Tyfton (*Cynodon spp.*) and Coast cross [*Cynodon dactylon (L.) Pers*] grass and for stargrass (*Cynodon nlemfuensis, Vanderyst*).

During confinement, horses remained in individual masonry stalls of approximately 15 m² containing a bed of daily cleaned dry grass. In the stall, animals were fed with 13 kg of roughage, composed of a mixture of equal parts of sugar cane (*Saccharum spp.*) and elephantgrass, cultivar *cameroon (Pennisetum purpureum Schum)*. Ration (1 kg for 100 kg/wv), with 13% protein, was daily provided. Animals were given *ad libitum* access to salt and water.

Mucilage and glycolic extract of *Aloe vera* leaves

In order to obtain the mucilage, *A. vera* leaves were collected and immediately taken to the laboratory of Enzymology and Protein and Peptides Biochemistry at the Department of Biochemistry and Molecular Biology at UFV. Leaves were washed, dried and sectioned in the middle for mucilage scraping.

Methods to obtain *A. vera* glycolic extract were done according to Dorneles *et al.* (2003) with a few changes, since it was obtained by adding equal volumes of propylene glycol (Galena Química e Farmacêutica Ltda, Campinas, SP) and mucilage. Additionally, 0.05% Nipagin (Farmácia de Manipulação Botica Fontenelle, Viçosa, MG) was added to the mixture as a preservative, which was placed in an amber bottle and kept at 4°C, for 15 days to obtain the extract. Later, another dilution was made to obtain glycolic extracts at 20 and 50% v/v.

Horse hoof trimming

Animals underwent periodic trimming and evaluation of physical variables on all hooves (listed below under "Parameters for the evaluation of growth and balance of hooves") during 225 days. Measurements were made before and after each trimming and compared to the ones obtained at subsequent trimming procedures.

Before beginning topic treatment with *A. vera*, two trimming procedures were made. Treatment began immediately after the second one (time zero, T0). Once treatment has begun, trimming was made every 45 days in a total of five procedures (T2, T3, T4, T5, T6) (Figure 1). Standardized trimming followed a well known pattern, being done by the same person during the entire experimental period.

Local treatment with *Aloe vera*

All hooves of four horses were subjected to a weekly topic treatment with *A. vera* glycolic extract. One of the forelimbs and one of the hindlimbs, randomly chosen, were treated with 20% glycolic extract and the contralateral limb with the 50% extract. The other two horses were kept in the same location, subjected to the same feeding and sanitary handling as well as trimming every 45 days, however, they receive only topic propylene glycol, the extractor of *A. vera*.

Both *A. vera* extract and the extractor were applied using a sponge. Applications were made on the wall and sole of the hooves, followed by the animals confinement in stalls for approximately 12 hours to allow a greater contact time with the products. No standard volume was established for each application; however, the entire wall and the entire sole were moistened with the products.

Variables for the evaluation of growth and balance of the hooves

Hooves were macroscopically evaluated once a week. Every 45 days when trimming was done, variables for the evaluation of growth, sensibility and balance were measured. As previously mentioned, measurements were done before and after each procedure.

The criteria to establish the hoof balance was based on measurements of the heels height (medial/lateral) and the partial widths of the hoof (medial/lateral), as well as the hoof angle, as done by Almeida (2008). For a hoof to be considered in balance, it should present heels measurements (medial and lateral) and partial widths (medial and lateral) with a difference of no more than 0.3 cm between medial and lateral sides. Additionally, the angle of hooves should be between 45 and 50 degrees for forelimbs and between 50 and 55 degrees for hindlimbs ones (Stashak, 2002). Hooves growth was established by the wall length. All evaluated variables are listed below.

The length of the hoof wall was established on its dorsal portion, from the weight-bearing surface at the center of the toe to the proximal edge of the toe wall (coronary band) (Balch *et al.*, 1997).

A goniometer was used to measure the hoof angle, formed by the dorsal surface of the hoof wall and the ground surface (Balch *et al.*, 1995).

No treatment	<i>Aloe vera</i> treatment (time in days)				
	45	90	135	180	225
T0 e T1	T2	T3	T4	T5	T6

Figure 1. Trimming before (T0 and T1) and during (T2, T3, T4, T5 and T6) hooves treatment with *Aloe vera*.

Heels heights (medial and lateral) were measured on the palmar/plantar surface of the hoof from the most distal point in contact with the ground to the most proximal area, measured with a caliper rule on the elevated limb (Balch *et al.*, 1997).

The maximum hoof width measured at the area known as quarters, immediately palmar/plantar to the frog apex. In addition to the maximum width, the widths of the medial and lateral halves of the hoof, as well as the frog apex direction were verified (Ruohoniemi *et al.*, 1997).

Sole sensitivity was evaluated during trimming with a hoof tester. Hooves presenting positive results to the sensitivity test were graded as one (1) and negative ones as zero (0).

Aspects related to quality (shape, brightness and cutting consistency) and abnormalities (fissures, cracks and lesions) of the hoof were also evaluated.

Statistical analysis

As a function of the evaluated characteristics, hood balance was classified in a binary way (yes or no), based on the following variables: heels height (medial and lateral), hoof width (medial and lateral) and hoof angle (between 45 and 50° for forelimbs and 50 and 55° for hindlimbs ones), separately. Hooves growth, measured by the wall length, was classified using the same binary method, based on its presence or absence. For statistical analysis, hooves with balance measures (heels height, partial widths and hoof angle) considered normal were classified as "1" and the ones that did not, were classified as "0". Additionally, forelimbs were classified as "0" and hindlimbs as "1" for balance evaluation estimated according to *A. vera* concentration and treated limb.

During all five evaluation time-points (trimming at 45, 90, 135, 180 and 225 days after begging the experiment), the frequency of respective classes (yes or no) was noted as a function of the dose (0, 20 and 50%) of *Aloe vera* for chi-square test at a significance of 5%, aiming at verifying the relation between applied dose and binary responses. Evaluations along the experiment were important to include fewer animals in the experiment.

Regression analysis of the frequency of balanced fore- and hindlimbs was also performed as a function of *A. vera* dose (0, 20 e 50%). Qualitative variables (hooves balance and treatment) were analyzed descriptively. Statistical test was made using Excel (2007) and Minitab software (2010).

RESULTS AND DISCUSSION

Hooves of the six animals were irregular, brittle and dry during the first two trimming procedures. However,

three weeks after begging the treatment, the external layer of the wall exfoliated, mainly close to the coronary band. On following weekly evaluations, dryness reduced, with a better aspect regarding hydration. The farrier also noted a better cutting consistency, reporting hooves with important hard consistency becoming softer as the following trimming procedures were done. These findings were observed on all hooves, regardless of the treatment.

Peeling and a better hydration were considered a physiological response, possibly related to the handling procedures carried out since animals were kept part of the day in paddocks with a ground slightly humid because of the rain season. Nevertheless, the possibility that such findings are a result of the propylene glycol, the extractor used on treated and control animals, cannot be rejected since, according to Martins & Veiga (2002), this substance solubilizes keratine of the stratum corneum by occupying hydrogen bonding sites. On the following treatments, a progressive decrease on such exfoliation was observed until entirely stopping after four weeks of treatment.

After 60 days of the application of the 20 and 50% *A. vera* glycolic extract, hooves presented a clear area of growth close to the coronary band, not observed on control hooves. According to Pollitt (1998) and Turner (2002), growth and regeneration of the hoof wall occur from the coronary band where germ cells produce new cells that continually mature and keratinize.

Though this growth area remained visible during the rest of the experiment and has even increased in length, this finding did not influence variables measurements evaluated during the research since hoof growth (Table 1) was not associated ($p > 0.05$) to the topic application of the *A. vera* glycolic extract, indicating that treatment did not generate an increase in growth rate. The number of grown hooves was similar to the not grown ones, according to the extract used.

Controlled studies aiming at minimizing the influence of factors acting on hooves quality are necessary. According to Eustace (1994), environmental factors are important determinants of hooves quality and growth. It is possible that, despite a stimulus for growth, wall wear on other evaluated animals have overcome hooves

Table 1. Frequency of grown hooves based on the measurement done on the wall

<i>Aloe vera</i> extract concentration (%)	Grown	Not grown
0	19	21
20	18	22
50	23	17

growth rate. As stated by Martinelli & Ferrie (1997), in physiological conditions, hooves wear may be greater than growth if the ground is abrasive. In the present study, animals remained part of the day in stockyards with concrete ground and in paddocks with rich gravel ground.

Results referring to hooves balance, considering each evaluated variable (hoof angle, heels height and partial widths) of four hooves of six animals, along the five trimming procedures are presented in Table 2. Evaluation of the results showed a tendency of a greater number of balanced hooves when the highest concentration of *A. vera* was applied. This tendency was confirmed ($p < 0.05$) when the three variables were evaluated together (Table 3), representing hoof balance. When separately evaluated, only heels uniformity (medial and lateral) ($p < 0.05$) confirmed the results.

Data shown in this study cannot yet be compared with the ones of other researchers since, up to this moment, no scientific studies could be found evaluating the relation between hoof balance and the application of *A. vera* glycolic extract. However, it is important to note that periodic trimming together with the use of 50% *A. vera* extract was essential to obtain these results. Almeida (2008) found in a study with biotin at a dose of 20 mg per day per animal for 9 months that the better hoof quality

Table 2. Frequency of balanced hooves based on variables hoof angle, heels height and hoof partial widths

Hoof angle		
<i>Aloe vera</i> extract concentration (%)	Balanced	Unbalanced
0	20	20
20	21	19
50	24	16
Lateral and medial heels		
0	17	23
20	22	18
50	29	11
Medial and lateral partial widths		
0	19	21
20	21	19
50	22	18

Table 3. Frequency of balanced hooves considering variables (hoof angle, heels height and hoof partial widths) evaluated for 225 days

<i>Aloe vera</i> extract concentration (%)	Balanced	Unbalanced
0	5	35
20	6	34
50	14	26

was a result of periodic trimming and not due to the vitamin. Additionally, it has been established (Martinelli & Ferrie, 1997; Ovnicek *et al.*, 2003) that such care is essential for the quality and proper maintenance of hooves health, allowing better load distribution and a more uniform wear.

It is possible to observe in Figure 2 that the percentage of hooves in balance increased ($p < 0.05$) as a function of the concentration of the applied *A. vera*. Regression equation was $\hat{y} = 20.4977 + 0.2521D$ ($r^2 = 0.9938$) and $\hat{y} = 0.431D$ ($r^2 = 0.8619$), for fore- and hind limbs, respectively. Comparison of fore- and hindlimbs, independently of the evaluated animals, revealed a total of 8 forelimb hooves (33.3%) treated with 50% *A. vera* glycolic extract in balance. The same concentration of the plant on hindlimbs resulted in 6 hooves (25%) in balance. The application of the 20% extract resulted on balance (6.25%) of only forelimbs. Finally, 5 hooves (20.8%) receiving propylene glycol, also from forelimbs, were in balance. These results indicate better balance for forelimbs than hindlimbs, regardless ($p < 0.05$) of the plant extract. Study conducted by Canto *et al.* (2006) with 97 Criollo horses showed that all evaluated animals presented at least one type of conformational change in forelimbs. Results from the present study cannot be considered uninteresting since forelimbs support around 60% of the animal weight (Stashak, 2002), making it essential for them to be in full balance for the needed load bearing.

A possible limitation of the present work could be the absence of a control group, *i.e.*, a group with animals not receiving any treatment (*A. vera* extract or extractor). However, due to the exactness of these experimental procedures, the authors believe that this limiting aspect does not disqualify the study since unpublished results, important for professionals working with horse locomotor system, has been made available.

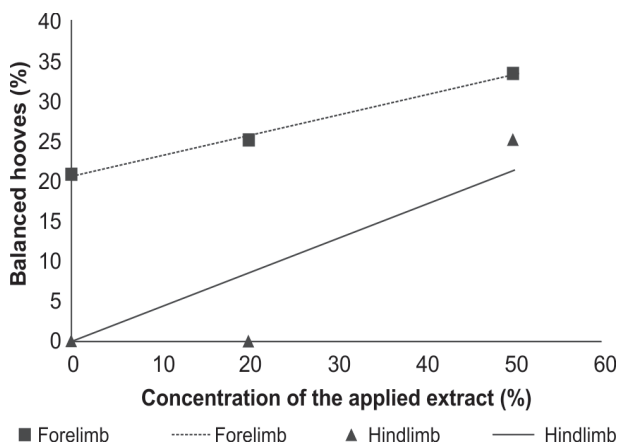


Figure 2. Relation between the increase in *Aloe vera* concentration and the increase in the percentage of balanced hooves

CONCLUSION

Topic treatment once a week with 20 and 50% *Aloe vera* glycolic extract during 225 days does not result in increasing rate of the growth of hooves. However, treatment with 50% glycolic extract together with periodic trimming promotes an important improvement of hoof balance what is essential for the proper load distribution during impact of the limb on the ground.

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