

General Articles

Hoof growth and wear of semi-feral ponies during an annual summer 'self-trimming' period

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Summary

Reasons for performing study: Despite growing interest in application natural models of hoof-maintenance in domestic horses, little data is available to describe natural conformation and proposed mechanisms of self-maintenance.

Objectives: Quantitatively describe hoof growth and wear during a period of 'self-trimming' within a herd of semi-feral ponies.

Methods: Hoof length, growth and wear were measured for a sample of 40 animals during a period of 'self-trimming' from June through September, 2005.

Results: For front hooves, mean toe lengths in July, August and September were significantly less than in June. For the hind, mean toe length in August was significantly less than in June, July and September. Increased rate of wear, as opposed to decreased growth rate, was the major contributor to overall shorter hoof lengths. Cumulative wear expressed as a percentage of the June baseline toe length ranged from 21–57% (mean 38%) for the front and 12–46% (mean 32%) for the hind.

Conclusions: Significant cracking, tearing and increased wear, known as 'self-trimming' is a measurable herd-wise phenomenon in horses maintained under natural social and environmental conditions.

Potential relevance: Although just one example herd, these data provide quantitative support of anecdotal reports of 'self-trimming' as a mechanism contributing to natural self-maintenance of the equine hoof.

Introduction

Newly emerging schools of equine hoof trimming are based on anecdotal reports of the wear pattern of horses living continuously in natural environments (Emery 1977; Jackson 1992; Strasser 2000; Ovnicek 2003; La Pierre 2006; Olivo 2006; Ramey 2006; Teskey 2006). The assumption of the natural model is that it promotes and maintains superior hoof health because feral equids or domestic horses that are self-maintaining appear conspicuously

free of foot problems (Emery 1977; Jackson 1992; Strasser 2000; Ovnicek 2003). The natural models are based on descriptive reports of small samples of free-ranging horses in North America at single points in time. To our knowledge, there have been no systematic longitudinal studies of self-maintaining feral or semi-feral horses.

Since 1994, a semi-feral herd of Shetland-sized ponies has been maintained at the University of Pennsylvania School of Veterinary Medicine. Consistent with reports of feral horses, these ponies have remained essentially free of foot-related lameness or clinical laminitis. Daily observations have indicated cycles of variable hoof growth and wear, resulting in widely varying length and shape with seasonal environmental changes. Shape and length appear functionally adapted for corresponding seasonal conditions.

In most climates and terrains, the hooves of free-roaming horses maintain reasonable length through natural wear (Emery 1997; Jackson 1997; Ovnicek 2003). In addition to ongoing wear of the contact surfaces, hooves typically undergo 'self-trimming' during which portions of the distal hoof chip and tear away (Ovnicek 2003). Within the herd, there are periods in which individuals are undergoing natural trimming (S. M. McDonnell, unpublished data). During wet periods, lush forage appears to promote growth and soft substrate that reduces wear and the toes become long. Then, when the substrate hardens, either during dry summer conditions or when frozen in winter, trimming commences. In the New Bolton Center herd, a period of trimming has occurred once or twice annually. Examples are depicted in Figure 1. In these ponies, trimming begins typically with cracking and breaking, at the rim of the medial and lateral quarters, continuing to the toe (Fig 1a, 1b right). In some instances, trimming begins with a horizontal crack that tears around the toe and opposite quarter (Fig 1b, left), less commonly with breaking, beginning at the toes (Fig 1b, centre). With trimming, hoof wall distortions appear to self-correct, for example from the long dishd toe to the 'ideal' form as depicted in Figure 1c. As pieces break off, the distal hoof edge initially appears irregular, but typically smoothes to uniformly rounded within one to 3 months. In most instances, the front hooves appear to begin trimming before the hind.

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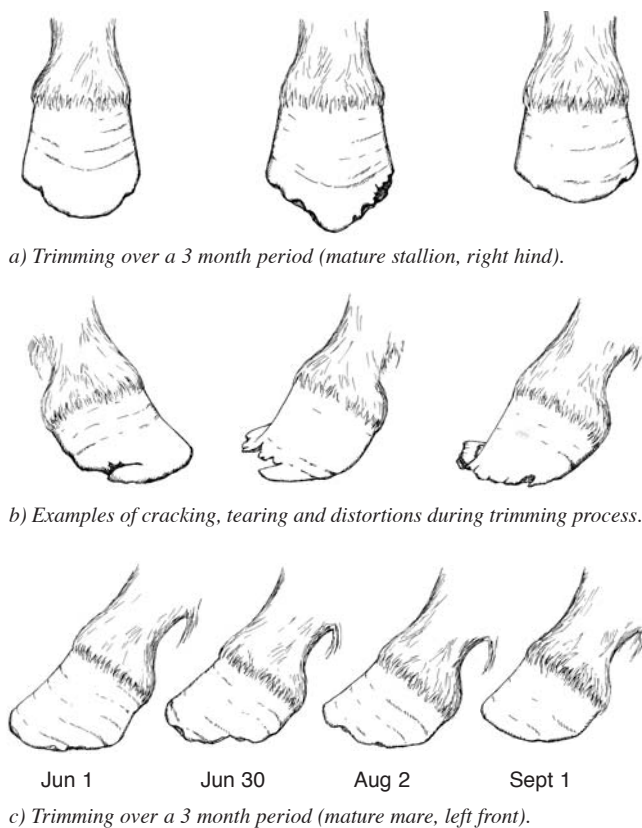


Fig 1: Illustration of the 'self-trimming' process drawn from photographs.

A longitudinal study is currently in progress to describe hoof conformation quantitatively, health, as well as growth and wear patterns of the herd, as one example of a population that is self-maintaining. One of the objectives is to describe quantitative morphological characteristics every 4 months for a 2-year period. This brief communication describes a substudy within this project in which growth and wear were measured monthly during a period of 'self-trimming'.

Materials and methods

Subjects

The study herd consisted of a semi-feral herd of Shetland-sized ponies, established in 1994 with 13 stallions and 13 mares assembled together at pasture for study of reproductive physiology and behaviour. The population size has been controlled at approximately 50–75 ponies by once annually removing one or more entire harem or bachelor bands. During this study the herd numbered 60 (June) to 65 (August) animals. Forty animals were studied, including 18 stallions and 18 mares (2–18 years of age) as well as 2 male and 2 female juveniles. One stallion was removed from the herd during the study.

The herd is kept relatively undisturbed on approximately 20 hectares of pasture with native grasses, light forest browse and several natural water sources. Supplemental grass hay is provided in deep winter. Animals receive minimum handling necessary for research sampling and measures. Positive reinforcement is used to gain and maintain compliance with necessary handling.

TABLE 1: Summary of front and hind hoof growth, wear and resulting length over a period of observed trimming

	Toe length mm (s.e.)	Average daily growth mm (s.e.)	Average daily wear mm (s.e.)	Cumulative wear as % of June toe length mean (range)
FRONT HOOF				
June 22–24 (n = 40)	70.6 (1.2) ^A	–	–	–
July 14–15 (n = 39)	67.1 (1.2) ^B	0.34 (0.02) ^A	0.52 (0.04) ^A	15% (0–33)
August 10 (n = 39)	65.1 (1.2) ^B	0.35 (0.02) ^A	0.41 (0.03) ^A	31% (0–47)
September 1 (n = 39)	67.3 (1.1) ^B	0.33 (0.02) ^A	0.24 (0.03) ^B	38% (21–57)
HIND HOOF				
June 22–24 (n = 40)	68.8 (1.1) ^A	–	–	–
July 14–15 (n = 39)	68.0 (1.2) ^A	0.31 (0.02) ^{AB}	0.36 (0.04) ^A	11% (0–38)
August 10 (n = 39)	67.4 (1.1) ^B	0.36 (0.02) ^A	0.35 (0.03) ^A	24% (7–42)
September 1 (n = 39)	69.2 (1.2) ^A	0.29 (0.02) ^B	0.22 (0.27) ^B	32% (12–46)

Within columns, entries not sharing common superscripts differ significantly ($P < 0.05$)

Hoof measurements

Hoof measurements were obtained over a 3 month summer period of trimming coincident with a hardening substrate during July, August and September (1.52 mm mean daily rainfall and mean daily average windspeed of 3.4 m/sec) following a long wet spring with predominantly soft substrate (2.54 mm mean daily rainfall with mean daily average windspeed of 4.2 m/sec for the preceding 3 months) (The Pennsylvania State Climatologist on-line database, <http://pasc.met.psu.edu/cgi-bin/daily.cgi>). Hoof measurements for our multi-year study had been taken on June 22–24, 2005. To enable estimation of hoof growth and wear over time, a mark (0.5 cm long x 1 mm deep x 1 mm wide groove) was drilled (cordless hand drill)¹ at that time on the dorsal midline, 1 cm distal and parallel to the coronary band of the left front and left hind hoof of each subject. Three days after these June measurements, new cracking and tearing was observed in several ponies, suggesting the onset of a trimming period for the herd. To describe hoof growth, wear and toe length over this trimming period, toe measurements were repeated at approximately 3-week intervals until the trimming appeared completed for most of the herd. This resulted in 4 sets of measures: June 22–24 (3 days before trimming became apparent), 14th–15th July, 10th August and 1st September. Additional measurements were done monthly for the remainder of 2005 (28th–29th September, 3rd November and 2nd December).

At each occasion, for each left front and left hind hoof, a digital electronic calliper was used to measure the distances along the dorsal midline of the hoof (1) from the coronary band to the mark and (2) from the mark to the distal edge. All measurements and observations on all occasions were done by one technician (L.F.). Intra-observer reliabilities for these 2 measurements under field conditions with these subjects are excellent (5 subjects, 3 replicates per subject, Pearson $r > 0.93$ for coronary band to mark and > 0.99 for mark to toe). On 22nd–24th June and 28th–29th

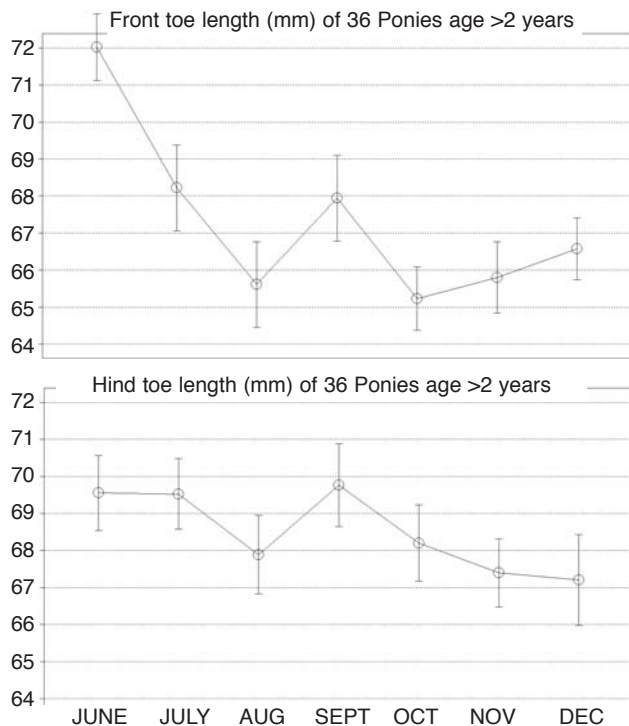


Fig 2: Front and hind mean \pm s.e. toe length (mm) for 36 ponies age ≥ 2 years over a 6 month period.

September any coronary band distortions as well as medial, lateral or toe wall distortions were recorded.

Statistics

Statistix Version 8² was used for data summary and analysis. For each occasion, average daily growth and average daily wear since the previous measure, cumulative wear since the June baseline, and toe lengths were calculated for front and for hind. For each measure, differences among intervals as well as between front and hind hooves were evaluated using repeated measurements ANOVA.

Results

Measurements

Toe length, average daily growth, average daily wear and cumulative wear as a percentage of June toe length for front and hind hooves for each measurement interval are summarised in Table 1.

Toe length: Mean toe lengths in July, August and September were significantly ($P < 0.05$) less than in June for front hooves; and in hind hooves, length in August was significantly ($P < 0.05$) less than in June, July and September. For 39 ponies measured on all 4 occasions during the 11-week period of trimming, for the front hoof 3 ponies had their shortest toe length in June; 13 in July, 18 in August and 5 in September. For the hind hoof, 8 ponies had their shortest toe length in June; 13 in July; 11 in August and 7 in September. Mean toe lengths for only the 36 mature animals over the 11-week period of trimming as well as for 3 subsequent monthly measurements are shown in Figure 2. Over the 6 month period, both for front and hind hooves, mean toe length was shortest in August.

Growth: For the front hooves, mean daily growth was similar for each interval (repeated measurements ANOVA, $P > 0.10$). For the hind hooves, mean daily growth for the July to August interval was significantly greater than for the August to September interval (repeated measurements ANOVA, $P < 0.05$).

Considering the entire 11 week period of the study, daily growth rates ranged 0.25–0.49 mm mean 0.34 mm (s.e. 0.01) for the front and 0.17–0.41 with a mean of 0.32 mm (s.e. 0.01) for the hind. The difference between front and hind growth rate was significant (dependent t test, 37 df, $P < 0.05$).

Wear: For both front and hind feet, mean daily wear was greater for June to July and July to August intervals than for August to September. Cumulative wear over the entire 11 week study, expressed as a percentage of the June baseline toe length ranged 21–57% (mean 38%) for the front and 12–46% (32%) for the hind.

Distortions

At the June examination, when hooves were long, 35 of the 40 ponies had one or more hoof wall distortions (quarter flares or toe dishes; Butler 1997; Fig 1b). When examined at the end of September, for 13 of those 35 individuals, those distortions were no longer evident. For the hind hoof, 26 individuals that had one or more distortions in June, 15 no longer had evidence of those distortions in September. No coronary band distortions were evident.

Discussion

These data describe quantitatively hoof length, growth and trimming of a semi-feral herd of ponies over a period of 'self-trimming'. Over a period of 11 weeks during summer with dry hard substrate, a considerable portion (with an individual maximum of 57%) of the starting hoof length was worn or trimmed away. Over this period, increased wear, as opposed to decreased growth, was the major contributor to overall shorter hoof lengths. Consistent with our previous observations (S. McDonnell, unpublished data 1995-2004), these data indicate that trimming of the front hooves preceded the hind.

'Self-trimming' of the hoof includes cracking and tearing of significant portions of the distal hoof followed by wearing that eventually results in a uniformly shorter toe length. In domestic horses, cracks and tears are generally perceived as undesirable. In this herd, cracks and tears are mostly limited to these periods of active 'self-trimming'. Depending upon the weather-influenced character of the substrate, there is a variable period during which hoof edges appear ragged after tearing, but the toes invariably smooth out to a uniformly rounded edge. Hoof wall distortions are also considered undesirable in domestic horses, possibly reflecting underlying disease or suggesting impending lameness and requiring correction (Balch 1995). In this herd, mild to severe hoof wall distortions occur as the hooves become longer but, as observed in this study, typically self-correct over fairly brief periods of wear and trimming. In its 12 year history, the herd has been completely free of foot problems or lameness. Obviously, differences in the environment, including locomotion and substrates, contribute to this difference between domestic and semi-feral animals.

Based on subjective observations, Ovnicek (2003) commented that in self-maintaining pastured or wild horses the 'self-trimming' process maintains the distal phalanx in a parallel

medial-lateral orientation to the ground. Orientation of the distal phalanx to the ground was not measured in our current study, however visual inspection tended to support Ovnicek's contention. Radiographs would be required to confirm this.

This current work documents quantitatively a period of 'self-trimming' in an example semi-feral herd that is not subjected to any hoof care. Consistent with systematic observations of this herd over several years, these data provide quantitative evidence that length and shape of healthy self-maintaining hooves vary over time. In addition to ongoing hoof wear, discreet periods of significant trimming are observed throughout the herd. The larger study of this herd now in progress should provide additional relevant quantitative data, including growth and wear rates and morphological variation over time.

Acknowledgement

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Manufacturers' addresses

¹Dremel, Racine, Wisconsin, USA.

²Analytical Software, Tallahassee, Florida, USA.

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Author contributions Both authors contributed to all aspects of this study.