Farriery and hoof care practice in a selection of New Zealand sport horses

STUDENT: T.C. (TJARDA) SINNIGE, 3516180

SUPERVISOR: DR. C.W. (CHRIS) ROGERS

EXAMINER: PROF. DR. P.R. (RENÉ) VAN WEEREN

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND

Universiteit Utrecht

2014-2016

Note: This research, which is part of a cross-sectional study, has recently been published (Dijkstra *et al.*, 2016) and might show similarities with the citation below:

Dijkstra, A. M., Sinnige, T. C., Rogers, C. W., Gee, E. K., & Bolwell, C. F. (2016). Preliminary Examination of Farriery and Hoof Care Practices and Owner-Reported Injuries in Sport Horses in New Zealand. *Journal of Equine Veterinary Science*, *46*, 82-88.

Keywords

Horse; Hoof; Conformation; Farrier; Trimming and Shoeing; Symmetry

Summary

Reasons for performing study: There is limited published literature about New Zealand dressage and show jumping horses and their hoof conformation. This is an introduction to describe the farrier- and hoof management.

Objectives: To describe the external forelimb hoof conformation, hoof care management and farrier practice in a cohort of dressage and show-jumping sport horses in New Zealand which are predominantly kept at pasture.

Methods: Retrospective management and owner-reported injury data, and measurement of forelimb hoof conformation, were collected via a cross-sectional questionnaire and digital images from a convenience sample of 96 registered show jumping (n = 67) and dressage (n = 29) horses.

Results: Nearly all horses were shod with conventional fullered shoes by 53 different farriers. Asymmetrical feet were identified in 29 of 94 (31%) horses. The difference between the mean dorsal hoof wall angle and palmar hoof angle is greater than 5°.

Conclusions: This population of New Zealand sport horses tend to have low and underrun heels. There is a significant association between owners reporting hoof problems and the occurrence of asymmetrical front feet.

Potential relevance: This study is a good first step for the introduction about farrier practice, hoof management and hoof conformation of the New Zealand competing sport horses.

Introduction

Early retirement of sport horses should be avoided as it results in economic consequences. Economically the contribution of the sport horse sector of the New Zealand equine industry is comparable to that of the racing industries (Matheson and Akoorie, 2012). In general, it is accepted that musculoskeletal injuries are the major reason for early retirement of the equine athlete. Poor foot conformation has been identified as a risk factor for musculoskeletal injuries (Ducro *et al.*, 2009a). Therefore, there is significant industry focus on appropriate hoof care to avoid lameness and optimize performance of the horse.

The exact definition of lameness is difficult, whereas most clinical manifestations of lameness in the horse are well known (Ross and Dyson, 2010). There are multiple causes for lameness resulting in signs of inflammation, including pain, or a mechanical defect. A mechanical defect can result in an abnormal gait, but probably the most common cause of lameness is repeatedly applied stresses that exceed the capacity of the tissues (Parks, 2003). The distal limb contains several tissues: tendons, ligaments, capsules, arteries, veins, nerves and bone structures which could be affected. The external form of the hoof is indirectly related to form and function of the internal structures of the equine hoof and limb (Johnston and Back, 2006).

Two terms which do refer to the distal limb are used frequently, hoof conformation and hoof balance. They both refer to the shape and size of the distal limb. Hoof conformation describes the shape of the hoof and conveys the size and relative proportion of the limb (Ross and Dyson, 2010). Hoof balance is considered to describe the static (geometric) and dynamic (functional) interaction between the hoof and the ground during exercise and at rest of the limb (Parks, 2003; Ross and Dyson, 2010). So hoof balance embraces both the conformation and function of the hoof. It is the hoof balance which can be manipulated directly by the clinician (Parks, 2003). An important factor that helps keeping the equine hoof and the distal limb in good health and thus benefits performance is maintaining an optimal balance of the hoof and distal limb, which is crucial in the interaction of movement, trimming, shoeing and ground surfaces (Johnston and Back, 2006). So, optimizing a proper balance will give an optimal conformation. This indicates the importance of keeping the external hoof properly maintained by the clinician.

With a shoeing interval of 8 weeks there was a significant increase in the moment on the distal interphalangeal joint (DIPJ), which resulted in an increased load of this joint (Moleman *et al.*, 2006). According to the anatomy of the equine distal limb, the structures that are most affected by the increased moment of the DIPJ are the deep digital flexor tendon (DDFT) and the navicular area. The DDFT is affected because it supposed to be in dynamic equilibrium with the DIPJ, and therefore suffers a larger risk of injury if the moment on the DIPJ is increased. To reduce the negative effect on the internal structures of the equine foot, it is necessary to keep the shoeing interval short (Moleman *et al.*, 2006). The farrier is responsible for providing an optimal balance of the hoof shape in relation to the lower limb conformation. Recently, a study reported the relation of the ideal lower limb conformation in association with the hoof shape and conformation of semi-feral horses (Gordon *et al.*, 2013). Often a feral horse population is promoted as the “gold standard” for hoof conformation (Ovnicek *et al.*, 1995), but this rather romantic view is not always realistic. Hampson *et al*., (2010) observed a broad range of foot abnormalities within the population Kaimanawa horses and concluded that the feral horse foot type should not be used as an ideal model for domestic horses (Hampson *et al.*, 2010).

It has been proposed that laterality in the young foal may predispose to asymmetrical hoof size and shape, and a positive association between lateral preference and asymmetrical feet has been documented (van Heel *et al.*, 2010). Sport horses with an appearance of asymmetrical feet retired earlier from the sport than horses with symmetrical feet (Ducro *et al.*, 2009a). This risk factor, i.e. the undesirable aspect of distal limb conformation (uneven feet), results in uneven limb load (van Heel *et al.*, 2010). Within the Dutch Warmblood population, $\pm$8% of horses present with asymmetrical forefeet and have a trend for mildly narrow feet with lower heel height. However, the association of lower scores in hoof conformation and asymmetrical forefeet with a shorter registration life was only significant in elite level show jumpers, but not in basic level show jumpers. Within dressage there was a trend towards shortening the competing life of horses (Ducro *et al.*, 2009a). The hoof responds dynamically to load, and there may be a heritable component to hoof conformation (Ducro *et al.*, 2009a). Although there is a lack of evidence, breeding societies will reject horses with asymmetrical feet at studbook inspections. They believe in a heritable component (van Heel *et al.*, 2010), despite the fact that the heritability of this aspect of foot conformation has not been proved.

A few hoof standards are generally accepted to be characteristic of an ideally conformed horse without lameness. The dorsal hoof wall and heel length should be parallel, with a straight hoof-pastern-axis (HPA). The ‘ideal’ conformation ratio between the dorsal hoof length and heel length is 3:1 (Dyson *et al.*, 2011). Viewed from the lateral aspect the recommended hoof angle is for the forefeet 50º to 54º (Balch *et al.*, 1991). The heel angle should have the same angle as the dorsal hoof wall, however it is usually a few degrees less. Viewed from the dorsal aspect, the hoof should be approximately symmetric. However, it is frequently observed that the medial wall is slightly steeper (Parks, 2003). Persistent lameness may have influence on the shape and size of the hoof. The hoof of a lame limb is mostly observed to be narrower and more upright (Dyson *et al.*, 2011). Just as a long toe and low collapsed heel, which seem to be risk factors for foot-related lameness.

A previous study examining the use of allied health care in New Zealand equestrian sport horses identified a lack of integration of health care practitioners with the veterinarian and a lack of formal qualifications, or recognition of formal qualifications for additional health care practitioners (Meredith *et al.*, 2011). However, there is an increasing economic value and emotional interest in horses (Matheson and Akoorie, 2012). To keep them in good health and to assure performance in competition it is necessary for the equine sector to work preventively instead of only providing care and treatment when signs of clinical disease or injuries become manifest. Therefore, an integration of the roles of equine veterinarians with those of the farrier and physiotherapist (allied health therapists) is necessary to address not just the symptoms but to holistically and proactively address the probable causative factors in the management and training of a horse, if equine performance and welfare is to be maximized (Meredith *et al.*, 2011; Rogers *et al.*, 2012). Limited data has been published about this subject in sport horses participating in dressage or show-jumping which have routine hoof care (Gordon *et al.*, 2013). The aim of this cross-sectional study is to describe the external hoof conformation of the front limbs, and hoof care management and farrier practice in a cohort of dressage and show-jumping sport horses in New Zealand which are predominantly kept at pasture. It was hypothesized that: 1) hoof conformation would not be significantly different between the New Zealand dressage and show jumping horses; 2) because New Zealand owns a lot of Thoroughbred horses the hooves will be more flattened compared to Warmbloods overseas; 3) there would be a high prevalence of stone bruises, because the sport horses are kept predominantly at pasture.

Materials and methods

Sampling Frame

Data were collected via a cross-sectional survey at 4 major national competitions in the lower North Island of New Zealand, during February and March 2014. These were Manfeild Park show jumping (regional 1* show), National Dressage Championships (National 3* show), North Island Showjumping Championships (National 3* show), and the Horse of the Year Show (National 3* show jumping and dressage show).

The survey was pilot-tested with two iterations on three competitive riders in different disciplines. Riders competed with multiple horses at different levels. The riders were not familiar with the survey, and the pilot-tested surveys were not included in the final data. Based on a convenience sampling protocol at each competition, the interviewer went to each horse truck or float, approaching riders and explaining the survey before requesting participation. Data for a single horse were obtained from each owner and responses were treated anonymously and confidentially.

Questionnaire Design

The questionnaire (attachment 1) consisted of 22 open or closed questions delivered by two interviewers experienced with the sport horse industry. The questions were divided into three sections: (1) general horse information (i.e., age, breed, height); (2) husbandry and training information (turnout time, use of arena, training schedule); and (3) injury and hoof care (reported injury type and duration and general data on hoof care practice).

Hoof Measurement

For each horse, a hoof care checklist (attachment 2) was obtained. Via the checklist the hoof symmetry, the presence of hoof rings, type of shoeing and wearing of the shoes was noted. Digital images were obtained of the forelimbs and hoof sole by one author using a compact digital camera (Nikon Coolpix S6300). For each horse, lateral, dorsal and solar views of each hoof were obtained with the camera at a foot-camera distance of approximately 1 m. The camera was centered mid-way between the dorsal and palmar side of the coronary band for the lateromedial photograph or mid-way between the lateral and medial side for the dorsopalmar view. For the solar image, the hoof was held up and the camera aimed perpendicular to the sole. Within the field of view, the images were identified by a 100-mm pro forma identification card, held in the same transverse plane as the hoof, which provided at the same time the object for calibration for subsequent image analysis.

Data were collected using a measurement protocol modified from a previous study (Gordon *et al.*, 2013) and using linear and angle measurement parameters previously used in a study of lateral hoof aspects (Dyson *et al.*, 2011). In brief, digital images were uploaded into ImageJ 1.48v (National Institute of Health) for linear and angle measurements. Measurements were made of the dorsal hoof angle (DHA) and dorsal hoof wall length (DHWL), coronary band length (CBL), dorsal coronary band height (DCBH), palmar coronary band height (PCBH), palmar heel angle (PHA), and heel length (HeL). From the solar surface view, measurements were made of the hoof width (Hoof W; width of the hoof at its widest point), hoof length (Hoof L; length of the solar ground bearing surface), frog length (Frog L; the distance from the buttress of heels/palmar hoof line to the point of frog), distance from the widest point of the hoof to the most caudal solar surface (Heel L; buttress of heel/palmar hoof line) and lateral and medial length (Figure 1A and 1B). Within-operator trials based on five repeated measurements per parameter demonstrated high repeatability of measurement with coefficients of variation below 2%.

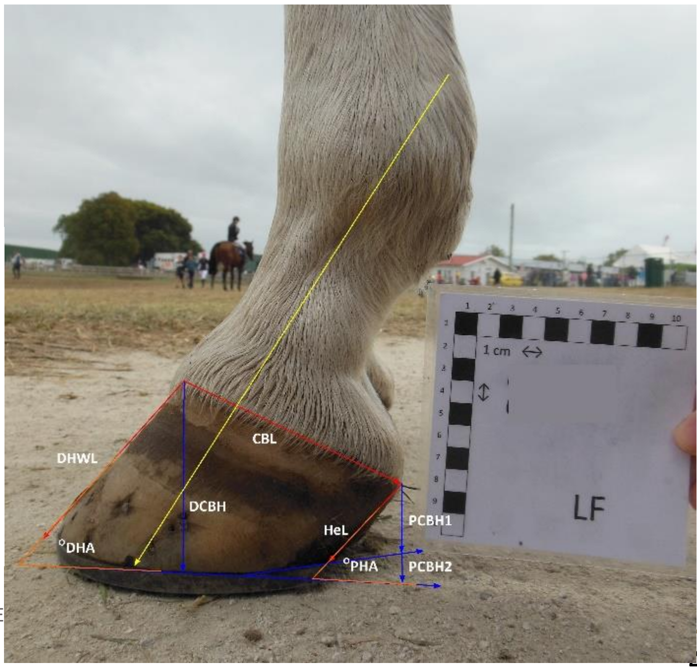
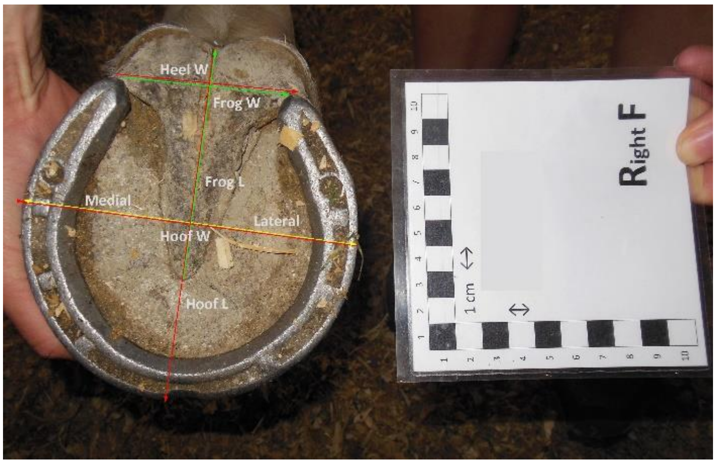


FIGURE 1A: Example of the lateral view of hoof with calibration card and reference lines used for measurement. Photograph showing how the dorsal hoof wall length (DHWL), coronary band length (CBL), dorsal coronary band height (DCBH), palmar coronary band height (PCBH), dorsal hoof angle (DHA), palmar heel angle (PHA), heel length (HeL) and line of the hoof pastern axis (yellow line) measurements were obtained.

FIGURE 1B: Example of the solar view of hoof with calibration card and reference lines used for measurement. Photograph showing how the dorsal hoof length (HoofL), hoof width (HoofW), heel width (HeelW), medial sole width (Medial), lateral sole width (Lateral), frog length (FrogL) and frog width (FrogW) measurements were obtained.



Data Analysis

Data were recorded on a pro-forma recording sheet, then coded, and manually transcribed into Microsoft Excel (Microsoft Corporation, Redmond, WA). Summary statistics were used to identify missing data, outliers, or errors in the data. Descriptive statistics for continuous variables were tested for normality and then presented as mean ± standard deviation or median and interquartile range (IQR). Differences between groups (show jumping vs. dressage horses, pony vs. horse) for demographics and hoof measurement data were tested using either an analysis of variance (ANOVA) or Kruskal–Wallis test. The distribution of the categorical variables was examined using either a chi-square tests or, if cells had low counts (<5), a Fisher's exact test. The associations of hoof measurement parameters, management data, and the inability to train were examined using multiple correspondence analysis (MCA). Multiple correspondence analysis provides a graphical technique to identify clustering of variables due to the relative position of their Euclidean values on a two-dimensional plot. All statistical analyses were performed using STATA 12 (StataCorp LP, College Station, TX) with a significance level set at $P < 0.05$.

Results

Horses

Questionnaire and digital images of the front limbs and feet were completed of 96 randomly selected horses: Manfeild Park showjumping (n=15), National Dressage Championships (n=25), North Island Showjumping Championships (n=25) and the Horse of the Year Show (n=31). A description of the horses which participated is presented in Table 1. Data were available for a larger number of horses used for show jumping (67/96, 70%) than dressage horses (29/96, 30%). Of the total 61/96 (63.5%) were males (all geldings, except for a single stallion used for dressage), and 35/96 (36.5%) were females. There was a strong preference for the use of Warmbloods within dressage, whereas the breeds used in show jumping are more variable.

TABLE 1: General descriptive demographics of the sample population of dressage and show jumping horses obtained via cross-sectional survey of riders at four equestrian shows in New Zealand.

Descriptors	Dressage	Show jumping	Total
Number of horses n=96 (%)	29 (30.2%)	67 (69.8%)	96 (100%)
Mean age (y)	8 (IQR 7-13)	9 (IQR 7-12)	9 (IQR 7-12)
Sex: (%)			
- **Female**	13 (44.8%)	22 (32.8%)	35 (36.5%)
- **Male**	16 (55.2%)	45 (67.2%)	61 (63.5%)
Height (cm)	167.5 (IQR 165-170)	162.5 (IQR 155-167.5) *	165 (IQR 160-167.5)
Breed			
- **Stationbred (%)**	6.9	31.3	24.0
- **Thoroughbred (%)**	0.0	11.9	8.3
- **ThoroughbredX (%)**	6.9	19.4	15.6
- **Warmblood (%)**	79.3	28.4	43.8
- **Other (%)**	6.9	9.0	8.3

Abbreviation: IQR, interquartile range; Stationbred; horses of mixed blood (Clydesdale, Thoroughbred and Standardbred, sometimes with infusions of American Walking Horse or Lipizzaner, etc.).
* Significantly different $P < 0.05$

The dressage horses competed between level 1 and level 9 with a median at level 4. The show jumpers competed between the classes of 0.95-meter-high up to 1.50 meter, median at 1.20 meter. Between the disciplines there was no significant difference for the distribution of competition level of the horses.

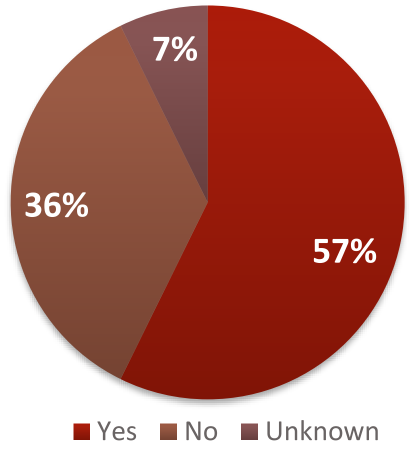
Farrier questionnaire analysis

The population of horses were trimmed and shod by 53 different farriers; in 4/96 horses the farrier was unknown. From the total, 22/53 farriers were registered at the New Zealand Farriers Association and allowed to call themselves a master farrier. The majority of the New Zealand sport horses are maintained by a master farrier (57%), Figure 2.

The routine interval for trimming and shoeing was 5.5 (range: 3.5-8) weeks. The major reasons why owners use this routine interval were: to keep the hooves maintained (51/96, 53%), prevention because hooves grow fast and to avoid developing long feet (20/96, 21%), farrier recommends this interval (17/96, 18%), or horse is known with hoof problems (8/96, 8%).

Among the horses reported with hoof problems (n=34), 38% were dressage horses (13/34) and 62% were show jumping horses (21/34). There was no significant discipline-related

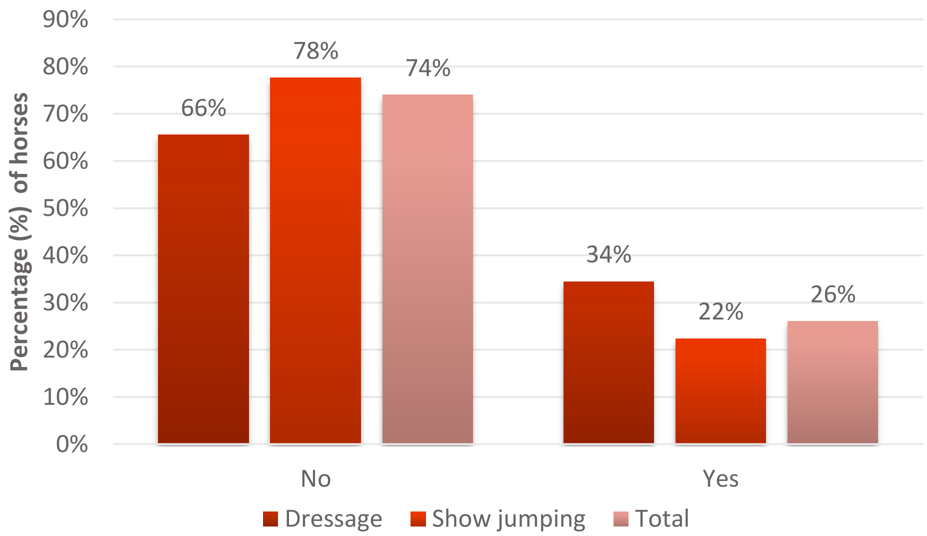
FIGURE 2: Overview of the sport horses (n=96) showing to which extent the farriery work is done by an NZ master farrier.



difference for observing any hoof problems. The most common hoof problems reported by owners were cracks (n=6) followed by flat hooves (n=4), upright hooves (n=4), orthopedic health related injuries (n=4), brittle hoof (n=4), and seedy toe (n=4). Other less commonly listed problems included abscesses/stone-bruises due to thin soles (n=3), unbalanced hooves (n-=2), cow-toe, chronic arthritis (n=1), keratoma (n=1) and contractive heels (n=1). The horse owners have been working with the farrier on these hoof-related issues, of which 29% (10/34) had been working on two or more hoof problems.

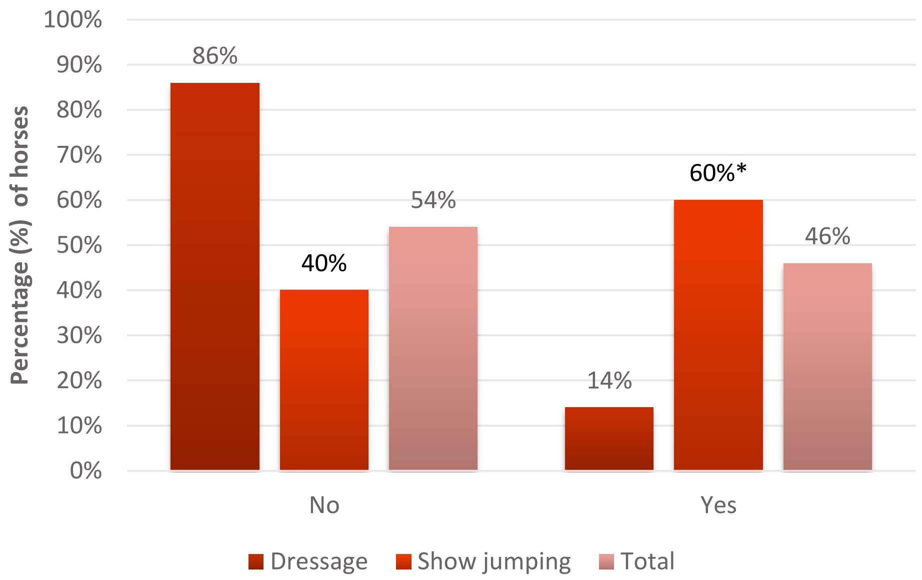
In association with the farrier, 26% (25/96) of the horse owners involved another specialist in their hoof care management (Figure 3). Specialists involved in this remedial work were a veterinarian (19/34) or an allied health practitioner (physiotherapist/chiropractor) working with the veterinarian (6/34). There was a trend for dressage horse owners to involve more often a specialist compared to owners of show jumpers, respectively 34% and 22%. Most owners (59%; 57/96) reported that the farrier decided what type of shoes were applied on the hooves, followed by 22% who decided in combination with the owner. In 10% of cases the decision was taken only by the owner, in 3% in a combination with the veterinarian, in 3% the veterinarian used X-ray a guidance to instruct the farrier and in just 2% the decision was taken by only the veterinarian.

FIGURE 3: Overview of the total number sport horses (n=96), divided into horses where an additional specialist was involved beside the farrier for the hoof care (bars to the right) and in those where this was not the case (bars to the left). Dressage horse owners seem to work more often with a veterinarian or physiotherapist than owners of show jumpers.



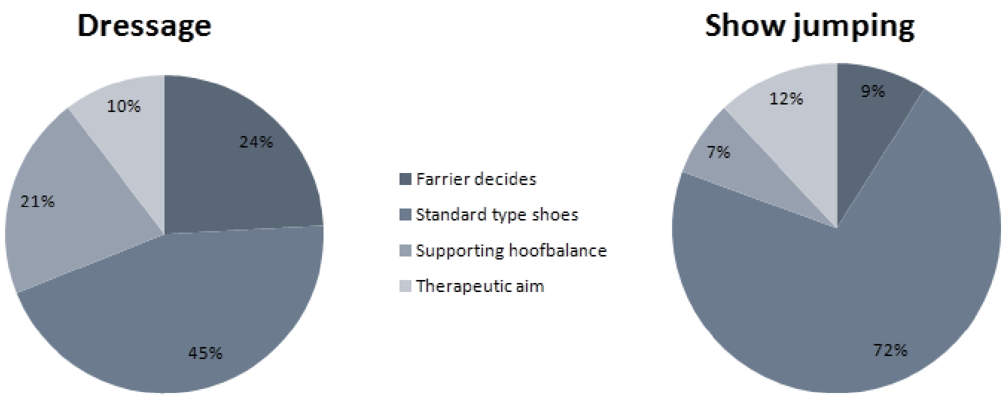
During the competition season, 89% (26/29) of dressage horses stayed most of the time at pasture, but during winter these horses were equally divided between limited pasture turnout and the most time at pasture (15/29, 51%). Most show jumping horses, 68% (46/67), had access to pasture (>12 hours) during the competition season, while during winter 80% (54/67) had limited pasture turnout. Between disciplines it was more likely that the show jumping horses had their shoes taken off during the non-competition season (P <0.001) (Figure 4).

FIGURE 4: Overview of the sport horses (n=96) that had (right bars) or had not (left bars) their shoes taken off during the off-season.
* Significant difference between dressage horse s and show jumpers (*P* <0.001)



There was no significant discipline related difference if the horse was uncooperative for farriers during farriery work, but there was a gender-related difference. Mares demonstrated significantly (P=0.05) more undesirable behavior during farriery work. Most of the horses were shod with a hot shoeing technique (71/94, 76%), with a full set of conventional fullered steel shoes (93/96) whereas 56% (53/94) had toe-clips, 38% (36/94) quarter-clips and 5% (5/94) no clip(s) attached to the shoes. Two horses were kept barefoot and one horse had aluminum shoes. Twenty percent of the shod horses (19/93) had a kind of therapeutic shoeing. Therapeutic features were: pad and/or gel used to reduce concussion to the hoof sole (n=9), Natural Balance shoes (n=7), heart bar shoe (n=2) and one horse with a heel wedge. Wearing of the shoes was most present on the dorsal side (toe, rolled toe), right foot (66.7%; 46/69) and left foot (60.6%; 43/71). For the right foot the wearing was reported at the laterodorsal side (n=7), mediodorsal side (n=6), total shoe (n=4), medial (n=4), and lateral (n=2) side of the shoe. For the left foot this was: laterodorsal (n=15), total shoe (n=7), mediodorsal (n=3), lateral (n=2) and lateropalmar (n=1). There were significant differences between disciplines for the reason 'why' a style of horse shoeing was used (P < 0.05), (Figure 5).

FIGURE 5: Overview of the owner response (n=96): '*WHY do you use this style of horse shoes/shoeing?*' Dressage horse owners describe more often why they use this style of shoe, show jumper owners seem to trust their farrier more and are mostly unaware of the type of shoeing. Significant difference (*P* <0.05) between disciplines.



In total, more than half the horses had shoes fitted with studs (66/94), most with two heel studs (65/94), and one dressage horse had four studs per shoe (two heel and two toe/quarter). Because of the ability to compete and train on sand arena's, dressage horses (17/27, 63%) had less of a need for stud holes compared to show jumpers (P < 0.001). Most dressage riders fitted equal size and type of studs to the medial and lateral heel (4/7), whereas show jumpers fitted different lateral and medial studs (23/36). If unequal studs were fitted, the longer studs were placed on the lateral heel (26/27).

To maintain the feet 93% (89/96) of the owners reported the use of some kind of hoof care product. Most common is the use of hoof oil (n=84), and supplements such as biotin (n=17) or others (n=16). Other methods to maintain the feet are soaking the feet with water and the use of tar.

Digital image analysis

The horses were last seen by a farrier 2.5 (range: 1-7) weeks previously at time of participation of the questionnaire and obtaining digital images of the front feet. Hoof measurements on digital images were successfully obtained for 91/96 horses. Five horses were excluded due to inability to obtain valid measurements for both forelimbs. The ponies (16/91, <15 hands high = 152.4 cm) did not show a significant difference within the analysis comparing to the horses, so the groups were combined. Hoof rings were observed in half of the horses (51/93, 54%). The data presented in Table 2 indicate a relatively homogeneous data set in relation to shape and size.

Ratios describing hoof balance demonstrated hoof conformation remained within the boundaries of accepted normal values for medial/lateral balance and hoof length relative to the proposed center of rotation of the proximal interphalangeal joint. The mean DHA was 55.1 ± 3.4° (range 43.1-62.0°), and was in most cases (n=85) greater than the HeL (mean 48.8 ± 6.5°; range 20.7-67.9°). The PHA and PCBH measurements indicated that many of the horses tended toward a low heel and/or underrun heel conformation. Forty-five percent of horses had a difference DHA-PHA of >5° (PHA >5° lower than DHA) in the left foot and 60% in the right foot. A difference of >5° between DHA-PHA is defined as an underrun heel, otherwise it is a low heel (>2° - <5°) or a normal conformation (O'Grady and Poupard, 2003).

Symmetry indices, Table 2, were within the expected boundaries for most parameters. The greatest variations in symmetry indices were in the palmar coronary band height measurements (PCHB1 and PCHB2) and the PHA. Tables 3a and 3b present the mean measurements and indicate the significant differences between the disciplines. Dressage horses have significantly greater hoof angles and medial hoof width compared to show jumpers (except for the right foot PHA).

TABLE 2: Results and comparison of the parameters of the hoof and shoe measurements of the dressage horses (n=27), show jumping horses (n=64) and total (n=91).

Descriptor	Dressage					Show jumping					Total				
	Left		Right		Symmetry Index (%)	Left		Right		Symmetry Index (%)	Left		Right		Symmetry Index (%)
	Mean	±SD	Mean	±SD		Mean	±SD	Mean	±SD		Mean	±SD	Mean	±SD	
DHWL (mm)	94.8	7.8	92.6	9.6	96 (90-98)	94.7	9.3	96.8	10	94 (90-97)	94.7	8.8	95.6	10.0	95 (90-97)
HeL (mm)	49.0	9.9	50.8	8.5	90 (78-94)	47.4	7.8	52.1	8.3	87 (77-94)	47.9	8.5	47.9	8.4	88 (78-94)
CBL (mm)	123.8	9.2	125.3	11.2	97 (92-98)	120.0	11.9	125.9	12.0	95 (91-98)	121.2	11.3	121.2	11.7	94 (91-98)
DCBH (mm)	102.2	11.4	101.7	11.8	95 (85-98)	98.5	10.8	102.8	17.6	92 (88-97)	99.6	11.1	99.6	16.0	93 (88-97)
PCBH1 (mm)	25.3	6.0	22.9	6.3	81 (64-87)	23.8	6.5	26.2	6.6	80 (68-93)	24.3	6.4	24.3	6.6	81 (68-90)
PCBH2 (mm)	56.9	17.2	52.2	10.8	85 (71-89)	55.3	11.7	54.7	10.4	85 (76-93)	55.8	13.5	55.8	10.5	85 (74-92)
Hoof L (mm)	141.0	12.4	146.2	13.1	94 (91-97)	137.7	11.0	142.3	10.8	95 (93-98)	138.7	11.4	143.5	11.6	95 (92-98)
Hoof W (mm)	143.6	12.1	148.0	15.4	94 (91-96)	136.7	13.1	141.8	13.4	96 (93-98)	138.7	13.2	143.7	14.3	95 (92-97)
Heel W (mm)	75.6	7.6	77.0	8.8	91 (85-97)	76.3	9.9	78.6	10.5	93 (88-98)	76.1	9.3	78.1	10.0	92 (87-98)
Frog L (mm)	92.3	8.4	96.8	8.7	92 (87-97)	90.8	9.1	92.3	9.5	95 (91-97)	91.3	8.9	93.6	9.5	94 (90-97)
Frog W (mm)	59.6	5.7	62.7	7.4	91 (86-97)	59.7	7.7	61.9	9.0	91 (86-94)	59.7	7.1	62.1	8.5	91 (86-95)
Medial (mm)	72.2	6.4	74.9	8.5	96 (90-98)	68.9	6.9	71.3	7.2	95 (92-98)	69.9	6.9	72.4	7.7	96 (91-98)
Lateral (mm)	71.1	6.1	72.5	7.4	93 (91-95)	67.4	6.7	70.0	6.9	95 (91-98)	68.5	6.7	70.7	7.1	94 (91-97)
DHA (°)	56.6	3.5	54.8	3.1	95 (92-98)	55.7	4.7	53.8	4.2	93 (90-98)	56.0	4.3	54.1	3.9	94 (90-98)
PHA (°)	52.5	7.3	44.2	10.8	86 (74-91)	50.1	7.5	47.9	6.3	91 (83-94)	50.8	7.5	46.8	8.0	90 (80-94)

Abbreviations: DHWL, dorsal hoof wall length; HeL, heel length; CBL, coronary band length; DCBH, dorsal coronary band height; PCBH, palmar coronary band height; DHA, dorsal hoof wall angle; PHA, palmar heel angle;

Measurement values reported as mean ± standard deviation; symmetry index values reported as median (interquartile range).

TABLE 3A: Results of the measurements of the left hoof in dressage (n=27) and show jumping (n=64) horses and the significant differences between them.

Descriptor	Dressage Mean	Dressage ±SD	Show Jumping Mean	Show Jumping ±SD	*P*-value
DHWL (mm)	94.8	7.8	94.7	9.3	0.9363
HeL (mm)	49.0	9.9	47.4	7.8	0.4094
CBL (mm)	123.8	9.2	120.0	11.9	0.1420
DCBH (mm)	102.2	11.4	98.5	10.8	0.1491
PCBH1 (mm)	25.3	6.0	23.8	6.5	0.3135
PCBH2 (mm)	56.9	17.2	55.3	11.7	0.6062
Hoof L (mm)	141.0	12.4	137.7	11.0	0.2073
Hoof W (mm)	143.6	12.1	136.7	13.1	0.0205*
Heel W (mm)	75.6	7.6	76.3	9.9	0.7450
Frog L (mm)	92.3	8.4	90.8	9.1	0.4810
Frog W (mm)	59.6	5.7	59.7	7.7	0.9399
Medial (mm)	72.2	6.4	68.9	6.9	0.0370*
Lateral (mm)	71.1	6.1	67.4	6.7	0.0163*
DHA (°)	56.6	3.5	55.7	4.7	0.0083*
PHA (°)	52.5	7.3	50.1	7.5	0.0220*

TABLE 3B: Results of the measurements of the right hoof in dressage (n=27) and show jumping (n=64) horses and the significant differences between them.

Descriptor	Dressage Mean	Dressage ±SD	Show Jumping Mean	Show Jumping ±SD	*P*-value
DHWL (mm)	92.6	9.6	96.8	10.0	0.0717
HeL (mm)	50.8	8.5	52.1	8.3	0.5057
CBL (mm)	125.3	11.2	125.9	12.0	0.8363
DCBH (mm)	101.7	11.8	102.8	17.6	0.7662
PCBH1 (mm)	22.9	6.3	26.2	6.6	0.0269*
PCBH2 (mm)	52.2	10.8	54.7	10.4	0.3019
Hoof L (mm)	146.2	13.1	142.3	10.8	0.1407
Hoof W (mm)	148.0	15.4	141.8	13.4	0.0605
Heel W (mm)	77.0	8.8	78.6	10.5	0.4894
Frog L (mm)	96.8	8.7	92.3	9.5	0.0471*
Frog W (mm)	62.7	7.4	61.9	9.0	0.7232
Medial (mm)	74.9	8.5	71.3	7.2	0.0414*
Lateral (mm)	72.5	7.4	70.0	6.9	0.1295
DHA (°)	54.8	3.1	53.8	4.2	0.0145*
PHA (°)	44.2	10.8	47.9	6.3	0.0465*

Asymmetrical feet were observed in 29 of 94 (31%) horses, there were no significant associations with disciplines. According to the definition (difference Hoof W >5%) 41% of the horses had asymmetrical feet. There was a significant association between owners reporting hoof problems and the occurrence of asymmetrical front feet ($P < 0.05$). There was no association between hoof problems and discipline (P=0.0680), gender ((P=0.6000) and breed (P=0.1560).

The ratios between the left foot and right forefoot, Table 4, showed a high similarity. The DHWL:HeL was slightly different, which supports that the right foot tended to have more a collapsed heel conformation compared to the left foot.

TABLE 4: Ratios of hoof capsule measurements in the left and right forefeet.

Descriptor	Left foot Mean	Left foot ±SD	Right foot Mean	Right foot ±SD
DHWL:HoofL	0.68	0.1	0.67	0.1
DHWL:HeL	2.03	0.3	1.89	0.3
DCBH:HoofL	0.72	0.1	0.71	0.1
DCBH:PCBH2	1.83	0.4	1.94	0.4
HoofW:HoofL	1.00	0.1	1.00	0.1
FrogL:HoofL	0.61	0.2	0.60	0.2
FrogW:FrogL	0.66	0.1	0.67	0.1
Medial:Lateral	1.02	0.1	1.02	0.1

Discussion

The data were collected as part of a convenience sample, and although this type of sampling may lead to a bias, previous use of this technique to collect data at competitions has provided robust data (Verhaar *et al.*, 2014), (Meredith *et al.*, 2011) and (Gordon *et al.*, 2013). The difficulty with the convenience sample of riders at a competition is the inability to accurately calculate a reliable response rate. However, sampling bias may be low as the demographics of the horses sampled in this study were similar to those published in other reports on the structure and distribution of horses within the show jumping and dressage disciplines in New Zealand (Friedrich *et al.*, 2011) and (Creagh *et al.*, 2010).

Dressage horse owners were more likely to involve a specialist in the hoof management compared to show jumper owners. They were also more likely to be directly involved in the decision to use which type of shoe for their horse. During a shoeing interval the hoof conformation changes. The major changes are a decrease in DHA together with an increase of the DHWL (±1 cm per month) (Moleman *et al.*, 2006; Parks, 2003; van Heel *et al.*, 2005). In this study the mean shoeing interval was 5.5 weeks, with the main reason for this interval being "to keep the hooves maintained". The practice of a short shoeing interval has the advantage that the horses compensate less for the changes of the hoof conformation. It is known that horses compensate when subjected to a shoeing interval of 8 weeks, with, inter alia, a broken backwards hoof-pastern axis. As a result, there is a significant increase in moment in the DIPJ. Given the anatomy of the distal limb, the DIPJ maintains a dynamic equilibrium with the DDFT. So, increasing the load of the DIPJ, increases the load on the DDFT which can influence the navicular area (Moleman *et al.*, 2006).

During off-season (winter) nearly half of the horses had their shoes taken off. This does have an effect on the weight-bearing patterns, because barefooted horses have a larger contact area with the ground surface, as both sole and frog also bear weight (Parks, 2003). It can be difficult for the horses to compensate for the abrupt changes of hoof conformation when taking off the shoes. The study of van Heel *et al.* (2005) observed that the center of pressure (CoP) location of newly shod horses was most often located in the mediodorsal quadrant of the front feet. After 8 weeks the horses have a tendency to shift the CoP to the palmar side of the foot. Although in this study there was no calculation of CoP, observing the wearing of the shoe gives an idea of foot placement. Most of the horses in this study were observed to have most wearing at the toe or dorsolaterally. This is in contrast to the report by van Heel *et al.* (2005), but is supported by the findings of Caudron *et al.* (1998). They concluded that optimal trimming can minimize the asymmetrical loading during foot placement of the internal structures, which could result in distal interphalangeal degenerative joint disease. This stresses the importance of realizing an optimal conformation, because it is essential to ensure the biomechanical balance (Caudron *et al.*, 1998). That the wearing was mostly observed at the dorsal side was expected. Almost all horses where shod with a flat conventional steel shoe and as a result of break-over the shoes will show wearing at the toe, which becomes rounded. There is a strong correlation with the angle of the dorsal surface of the distal phalanx with the surface, with a more acute angle increasing the load on the navicular bone during the break-over phase (Eliashar *et al.*, 2004; Moleman *et al.*, 2006). It would be interesting to do an imaging survey to see if the New Zealand sport horses, which tend toward a low or underrun heel conformation, show frequent abnormalities due to this overload on the navicular bone and DDFT.

Because the sport horses are kept predominantly on pasture it was hypothesized that bruising and sole abscesses would be to most common hoof problems, however only 3 horse owners reported this hoof abnormality. Tendon and/or joint injuries were also not commonly reported via the questionnaire. New Zealand young stock is mostly kept continuously at pasture, where most likely the uneven surface strengthens the soft tissues.

It is known that correction of the feet by regular trimming interval (4-8 weeks) is not enough to prevent the development of unevenness in foals, whereas uneven feet in mature horses are often related to lameness (Ross and Dyson, 2010; van Heel *et al.*, 2006; van Heel *et al.*, 2010). Ducro *et al*. (2009) observed that the appearance of uneven feet is a significant risk factor in elite jumping, almost doubling the risk of early retirement (Ducro *et al.*, 2009b). Asymmetrical front feet were identified clinically in 29% of the horses, yet only 5% of the horses were having therapeutic shoeing to address this. The low proportion of horses for which action was undertaken in the hoof care program to correct the asymmetry may reflect that many horse owners consider mild asymmetry to be acceptable and see this as normal conformational variation. The hoof measurements in the present study support this interpretation that much of the uneven feet that were identified were mild in nature and might be a reflection of natural asymmetry. Nevertheless, it is interesting that the horses reported in this study that had hoof problems did have a significantly higher prevalence of asymmetrical feet.

For the lateromedial (LM) images the sport horses needed to be standing square with all four limbs loaded, on pasture it was attempted to find the best possible horizontal surface. The camera was placed at 1m distance, perpendicular to the sagittal plane and positioned at the height of the fetlock, which method was chosen because it was most practical for use in the field. However, for a better technical result the heel bulbs would serve better as a reference point instead of the fetlock (van Heel *et al.*, 2005). Alternatively, the camera may be centered mid-way between the dorsal and palmar aspects of the coronary band (Dyson *et al.*, 2011). The ideal hoof angulation is said to occur when the DHWL and HeL are in alignment or parallel to a line through the three phalanges of the distal limb (O'Grady and Poupard, 2003), so any technique should aim at imaging these angles as well as possible.

Most sport horses in New Zealand used to be Thoroughbreds coming from the racing industry, therefore it is common to use the Thoroughbred breed or Thoroughbred crosses in competitions. In New Zealand, flat, brittle hooves are viewed a common trait of the Thoroughbred breed and even considered by some as hereditary. Therefore, it was hypothesized that the hooves would be more flat and brittle comparing to Warmbloods overseas. According to the hoof measurement data the hooves tended to have flat feet indeed; the difference between DHA-PHA was >5° (Table 3a, 3b), horses had a long DHWL and the ratio DHWL:HeL was 2:1 instead of 3:1. However, contrary to this hypothesis, the ratios on the solar surface of the hoof were similar to reports in the literature *(i.e. HoofL=HoofW; FrogL:HoofL=60%; Medial=Lateral; FrogW:FrogL=50-66%, Table 4)* (Dyson *et al.*, 2011; Parks, 2003). The weight of the horses involved this study was unknown, therefore it was difficult to apply the guidelines that have been proposed to establish the appropriate DHWL based on body weight (O'Grady and Poupard, 2003). Taking 525-575 Kg as a realistic estimate for the population of horses within this study, the DHWL should have been 89.0 mm according to those guidelines. However, the mean measurements were 94.7 ± 8.8 mm, suggesting that the DHWL is longer in our population comparing to the guidelines. The ratio measurements of the frog indicated that the horses presented with open rather than contracted heels and there was a trend for the hoof to be trimmed back at the toe to decrease break-over. This was supported by the DHA measurement being steeper than generally reported in the literature by approximately 2° to 3°. The greatest variation in hoof measurements between horses, and between feet, was observed in the heel measurements (both length and angles). This variation may be driven by some horses, or feet, presenting with low forward heels due to variation between farriers in how the heels were dressed at the time of shoeing and the level of caudal heel support provided. Within the industry, there appears to be some debate as to how to dress the heels and what should be the level of heel support. With most horses kept at pasture, farriers have traditionally shod horses with short heels to prevent horses overreaching and “pulling off the shoe,” and this practice may compromise the quality of the heel and create underrun heels. Underrun heels lead to the development of a broken-back HPA, which is the most commonly encountered hoof abnormality (O'Grady and Poupard, 2003). Like the occurrence of asymmetrical feet, this type of foot configuration is so common that it is thought to be normal. Gordon *et al.*, (2013) observed within a population of semi-feral horses a broken back hoof pastern axis, with a pastern angle of approximately 60º, although the hoof size and shape was within the normal expected range (Gordon *et al.*, 2013). During break-over, the hoof length determines the length of the moment arm on the navicular area. Changes as an excessive hoof length, and acute PHA and DHA can result in an increase of tension within the DDFT. These factors seem to play a role in the initiation of the long toe underrun heel syndrome and predispose to foot-related pain (Dyson *et al.*, 2011; O'Grady and Poupard, 2003). To repair and restore these damaged heels a description of a proposed technique for the farriers has been given in O’ Grady, (2003) (O'Grady and Poupard, 2003).

It could have been interesting to determine eventually significant differences between the left and right foot ratios (Table 4), although the hoof ratios tend to be similar.

In conclusion, this retrospective study showed that the population of New Zealand sport horses tend to have low and underrun heels, the difference between DHA-PHA was >5°, DHWL was relatively long and the ratio DHWL:HeL was 2:1 instead of 3:1. The population of horses had a moderate prevalence of fore feet scored qualitatively as asymmetrical. There was a significant correlation between owners who reported hoof problems and the occurrence of asymmetrical feet. Comparing the disciplines there were no great differences between the hoof measurements. Overall, this study is a good first step for the introduction about the farrier practice, hoof management and hoof conformation of the New Zealand sport horses.

Acknowledgements

I would like to thank the horse owners who participated in this study by answering the questionnaire and letting us take the digital images of their horses. A special thanks to Bernard Denton, Penny Castle and Nicola French for their help and patience to confirm the questionnaire. Of course thanks to Massey University by giving us the feeling of being home in our Dutchie room! And in this last stage of writing to Chris Rogers and René van Weeren, who are hopefully making my graduation possible.

References

1. Balch O, White K, Butler D. Factors involved in the balancing of equine hooves. J Am Vet Med Assoc 1991; 198(11):1980-9.

2. Caudron I, Grulke S, Farnir F, Vanschepdael P, Serteyn D. In-shoe foot force sensor to assess hoof balance determined by radiographic method in ponies trotting on a treadmill. Vet Q 1998; 20(4):131-5.

3. Creagh F., Hickson R., Rogers C. Brief communication: Preliminary examination of sport horse competition data for genetic evaluation. 2010:143-5.

4. Dijkstra AM, Sinnige TC, Rogers CW, Gee EK, Bolwell CF. Preliminary Examination of Farriery and Hoof Care Practices and Owner-Reported Injuries in Sport Horses in New Zealand. Journal of Equine Veterinary Science 2016; 46:82-8.

5. Ducro BJ, Bovenhuis H, Back W. Heritability of foot conformation and its relationship to sports performance in a Dutch Warmblood horse population. Equine Vet J 2009a; 41(2):139-43.

6. Ducro BJ, Gorissen B, van Eldik P, Back W. Influence of foot conformation on duration of competitive life in a Dutch Warmblood horse population. Equine Vet J 2009b; 41(2):144-8.

7. Dyson SJ, Tranquille CA, Collins SN, Parkin TD, Murray RC. External characteristics of the lateral aspect of the hoof differ between non-lame and lame horses. The Veterinary Journal 2011; 190(3):364-71.

8. Eliashar E, McGuigan M, Wilson A. Relationship of foot conformation and force applied to the navicular bone of sound horses at the trot. Equine Vet J 2004; 36(5):431-5.

9. Friedrich C, Koenig S, Rogers C, Borstel UKV. Examination of longevity in dressage horses-A comparison between sport horses in New Zealand and Hanoverians in Germany. Zuchtungskunde 2011; 83(1):68-77.

10. Gordon S, Rogers C, Weston J, Bolwell C, Doloonjin O. The Forelimb and Hoof Conformation in a Population of Mongolian Horses. Journal of Equine Veterinary Science 2013; 33(2):90-4.

11. Hampson BA, Ramsey G, Macintosh AMH, Mills PC, de Laat MA, Pollitt CC. Morphometry and abnormalities of the feet of Kaimanawa feral horses in New Zealand. Austr Vet J 2010; 88(4):124-31.

12. Johnston C, Back W. Hoof ground interaction: When biomechanical stimuli challenge the tissues of the distal limb. Equine Vet J 2006; 38(7):634-41.

13. Matheson A, Akoorie ME. Economic Impact Report on the New Zealand Sport Horse Industry. : The University of Waikato; 2012.

14. Meredith K, Bolwell CF, Rogers CW, Gee EK. The use of allied health therapies on competition horses in the North Island of New Zealand. N Z Vet J 2011; 59(3):123-7.

15. Moleman M, van Heel MCV, van Weeren PR, Back W. Hoof growth between two shoeing sessions leads to a substantial increase of the moment about the distal, but not the proximal, interphalangeal joint. Equine Vet J 2006; 38(2):170-4.

16. O'Grady SE, Poupard DA. Proper physiologic horseshoeing. Veterinary Clinics of North America: Equine Practice 2003; 19(2):333-51.

17. Ovnicek G, Erfle J, Peters D. Wild horse hoof patterns offer a formula for preventing and treating lameness. American Association of Equine Practitioners (USA) 1995.

18. Parks A. Form and function of the equine digit. Vet Clin North Am Equine Pract 2003; 19(2):285-307.

19. Rogers CW, Bolwell CF, Gee EK. Proactive management of the equine athlete. Animals 2012; 2(4):640-55.

20. Ross MW, Dyson SJ. Diagnosis and Management of Lameness in the Horse (Second Edition): Chapter 27 the Foot and Shoeing.: Elsevier Health Sciences; 2010. p. 282.

21. van Heel M, Van Dierendonck M, Kroekenstoel A, Back W. Lateralised motor behaviour leads to increased unevenness in front feet and asymmetry in athletic performance in young mature Warmblood horses. Equine Vet J 2010; 42(5):444-50.

22. van Heel M, Kroekenstoel A, Dierendonck Mv, Weeren Pv, Back W. Uneven feet in a foal may develop as a consequence of lateral grazing behaviour induced by conformational traits. Equine Vet J 2006; 38(7):646-51.

23. van Heel M, Moleman M, Barneveld A, Weeren P, Back W. Changes in location of centre of pressure and hoof-unrollment pattern in relation to an 8-week shoeing interval in the horse. Equine Vet J 2005; 37(6):536-40.

24. Verhaar N, Rogers CW, Gee EK, Bolwell CF, Rosanowski SM. The feeding practices and estimated workload in a cohort of New Zealand competition horses. Journal of Equine Veterinary Science 2014; 34(11):1257-62.

Attachment

1) **Questionnaire**

2) **Checklist Hoof Care Front Limb**

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND

Universiteit Utrecht

Document №:

How to Complete the Questionnaire

- *We are participating in a research project at Massey University.*
- *This cross-sectional survey is divided into three parts. The information will be used for two veterinary science research projects:*
  1) *A cross sectional survey of injuries in sport horses in New Zealand*
  2) *Farriery and hoof care practice in a selection of New Zealand sport horses*
- *All responses are treated anonymously and confidentially.*

PART 1: General information horse and rider

Name rider:_____________________________ Name horse:____________________________

Horse information:

1) **How old is your horse?** _______ years
2) **What sex is your horse?** ☐Mare ☐Stallion ☐Gelding
3) **What is the height of your horse?** _______ cm/hh
4) **What breed is your horse?** __________________________________
5) **How long have you owned/ridden this horse?** _______ years
6) **In which discipline is your horse trained?** ☐Show jumping ☐ Dressage
7) **At what level is your horse competing at the moment?**

Showjumping:

☐ 1,00 m ☐ 1,10 m ☐1,20 m

☐ 1,30 m ☐1,40 m ☐1,50 m

Dressage:

☐ Level 1 ☐ Level 2 ☐ Level 3 ☐ Level 4

☐ Level 5 ☐ Level 6 ☐ Level 7 ☐ Level 8 ☐Level 9

8) **At what age did the horse started competing?** (at what age was the horse broken?)

_______ years

Broken at: ____

PART 2: A cross sectional-survey of injuries in sport horses in New Zealand (2014)

Brief history of horse management:

1) **How many hours does your horse spend at pasture during spring, summer, autumn or winter?**

	Spring	Summer	Autumn	Winter
Not a pasture	☐	☐	☐	☐
< 12 hours	☐	☐	☐	☐
> 12 hours – 24 hours	☐	☐	☐	☐

2) **Approximately how many hours is your horse trained per week?** *(write down how many hours/minutes)*

Rides per week	
Warm up	
Cool down	
Training time	
Walker	
Hack	

3) **Do you train in an arena at home?**

☐NO (paddock) ☐ YES → **What kind of training surface do you use?**

____

☐Wood fibre ☐ Sand ☐ Sand/rubber mix ☐ Sand/plastic mix

☐ Geofibre mix ☐Gravel ☐ other; ____________________________

4) **Do you use any leg protection during pasture, training or stabling?**

	Training	Pasture	Stable
Polo wraps			
Bell boots			
Dressage boots			
Splint boots			
Open front boots			
Hind boots			
Paddock boots			

Other leg protection: ____
____

5) **On average, how many competitions do you enter per month?**

☐ 1 ☐ 2 ☐ 3 ☐ 4

How many classes do you enter per competition? _____classes

Comment: ____
____

6) **What is the frequency of competitions during the season?**
(put the appropriate number of competitions during each month)

	Number of competitions entered
September	
October	
November	
December	
January	
February	
March	

Injury history (during the last 12 months):

1) **Was your horse unable to train for > 7 days during the last 12 months?**

☐NO ☐YES

2) **If YES, what was the reason that prevented the horse from training?**

____
____
____

3) **If YES to 2, did the horse have one single problem or multiple problems through which the horse was unable to train for > 7 days during the last 12 months?**

☐SINGLE ☐MULTIPLE

Reasons: ____
____
____

4) **If there were multiple problems that prevented the horse from training, were they linked together or single, separated problems?**

☐LINKED ☐SEPARETE

If LINKED, please explain the problems:____
____

____

5) **Was the horse seen by a vet or specialist?** *(Specialist → ask what kind)*

☐NO ☐YES

If YES, what was the diagnosis:____

____

____

6) **For how long was the horse unable to train?** (*once or multiple times?)*

Duration: ____

____

____

7) **How did you (rider/owner) recognize the condition that prevented the horse from training?** *(clinical signs):*

____

____

8) **Where there any management chances (for example arena/farrier/leg protection/stabling) which may have caused the problem?**

____

____

PART 3: Farriery and hoof care practice in a selection of New Zealand sport horses

Name farrier:____

1) **Do you know if your farrier is a master farrier?** ☐ YES ☐NO
2) **When is your horse trimmed and shod for the last time?** _________ weeks ago
3) **What is the typical time in weeks between a normal trimming and shoeing?** _________ weeks
4) **Please explain WHY you choose this number of weeks to trim and shoe your horse:**

____

____

5) **For what kind of problems would you call your farrier for an off routine trimming/shoeing?**

____

____

6) **Have you observed any hoof problems with your horse?** ☐YES ☐NO

If YES, please explain:____

____

7) Is there another specialist involved in management of the horse's hoofcare?

☐YES ☐NO

If YES, who: ☐ veterinarian ☐ physiotherapist ☐other_________________

8) Who decides what type of shoes are applied on your horse's foot? *(Do they trust there farrier?)*

____

____

9) WHY do you use this style of horse shoes/shoeing?

____

____

10) Which technique is used to put on your horse's shoe? ☐ Cold shoeing ☐ Hot shoeing

11) Do you take the shoes off in the winter? ☐YES ☐NO

12) In which season do you think the condition of your horse's hooves are the best? (*Difference in performance?)*

☐ Summer ☐ Winter :____

13) Is your horse easy to trim and shoe?

(Observe any problems after farrier>Lameness? Easy lifting of limb? Difference between front and hind legs?)

____

____

14) Do you use any hoofcare products in your management? *(Feeding/oil etc..)*

☐YES ☐NO

If YES, please explain **WHY** and how often they use the product:_______________________________

____

15) The studs you use on the competition today, WHY have you chosen this type of stud?

(Please also ask if this is the common stud they use. If NO> which do they normally use and why? Ask about ground surface, hard/wet/loose, etc. When do they use long studs?)

____

____

____

16) Do you use the inside/outside placement of studs? ☐YES ☐NO

If YES, please explain **WHY** and which hoof they use this technique:

☐ Hindlimbs ☐ Forelimbs ☐ Both

☐ Long stud inside ☐ Long stud outside

____

____

CHECKLIST HOOFCARE FRONT LIMB

GENERAL INFORMATION

Document №	
Date	
Town/City competition	
Name rider	
Name horse	

CHECK HOOFCARE

1) **Horse is shoed:** ☐Barefoot ☐Full set ☐Shod only on front hooves

2) **Please draw the shoe(next page) for the front and hind shoe:**
   - Studholes
   - Toeclips/quarterclips
   - Specific theurpeutic changes
   - Wearing of the shoe

3) **If possible describe the studs used at the moment**
   a) Type; ____
   b) Length in mm; ____
   c) Inside/outside placement; ____
   d) Other, *please specify*; ____

4) **Therapeutic shoeing?** ☐ YES ☐ NO
   Please describe the material which is used:
   a) Shoe? ____
   b) Wedge? ____
   c) Equi-Pak? ____
   d) Hoof pad? ____

5) **Hoof symmetry:** ☐ YES ☐ NO
   ____

6) **Presence of hoof ring on forefeet:** ☐ YES ☐ NO
   __________________________cm underneath coronary band

LEFT

RIGHT

PHOTO OF THE HOOF

1) TAKE ALWAYS A MINIMAL OF TWO PHOTOS PER SUBJECT, IN CASE A PHOTO FAILED.
2) MAKE SURE HORSE STANDS SQUARE ON FLAT SURFACE

Photo 1: Whole horse L

DO: Make a photo of the hole **left side of** the horse

AIM: For cross sectional project to get a total view of the horse and the including survey

Photo 2: Whole horse R

DO: Make a photo of the hole **right side** of the horse

AIM: For cross sectional project to get a total view of the horse and the including survey

Photo 3: Behind horse

DO: Make a photo of the **behind** horse

AIM: For cross sectional project to get a total view of the horse and the including survey

Photo 4: Front view carpus > ground

DO: Camera in position straight line to fetlock, you are about 1 meter from the front side horse. Use of scale 90 degrees ruler lateral next to the cannon bone.

AIM: a) Overview photo of the standing position of the lower limb according to the hoof, upstandingness.

b) Cannon angle > Varus/Valgus.

Photo 5: Lateral image of carpus>groud

DO: Camera in straight line position on fetlock height, 1 meter beside horse. Use of scale 90 degrees ruler against palmar side of cannon bone.

AIM: Overview image of the limb.

Photo 6: Lateral image fetlock > ground

DO: Camera in straight position on fetlock height, 1 meter beside horse. Use of scale 90 degrees ruler against palmar side of fetlock.

AIM: a) Measurement hoof-pastern-axis

b) View of the foot slope

c) Measuring the heel height, dorsal hoof length, toe height, toe angle

Photo 7: Solar image of hoof

DO: Lift the hoof, camera 1 meter perpendicular on hoof sole. Use of scale 90 degrees ruler medial against the hoof.

AIM: a) Measuring the widest part of the hoof > internal center articulation area

b) Type of horse shoe and if possible the studs

c) The ground surface of the foot should be approximately as wide as it is long (red lines) and approximately symmetric about the long axis of the frog (blue lines). The heels should not project dorsal to the frog (courtesy of Dr Andy Parks).

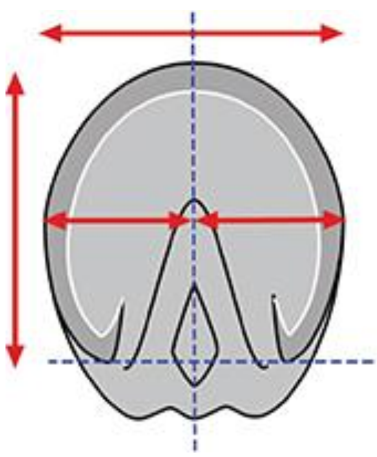


Photo 8: Palmer side hoof. Heel bulbs

DO: Camera in position straight line to heel bulb, 1 meter distance. Use of scale 90 degrees ruler lateral side of hoof on the ground.

AIM: a) Measurement of the heel bulbs.

b) Symmetric of the heel ground surface