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Original Research

# Preliminary Examination of Farriery and Hoof Care Practices and Owner-Reported Injuries in Sport Horses in New Zealand

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ABSTRACT

Retrospective management and owner-reported injury data, and measurement of forelimb hoof conformation, were collected via a cross-sectional survey from a convenience sample of 96 registered show jumping (n = 67) and dressage (n = 29) horses. Most of the horses were medium- to upper-level performers, aged 9 (interquartile range [IQR] 7–12) years, and in the current rider's ownership for 28 (IQR 12–60) months. The horses were trained 45 (IQR 35–60) minutes, 6 days per week, on a sand or sand mix arena. Failure to train for ≥7 days was reported in 26 of 96 horses, generally associated with lameness diagnosed by a veterinarian (16/29), with a median time-off of 26 (IQR 14–93) days. During the preceding 12 months, 33% of the riders had been working with the farrier on hoof-related issues, 30% of which had involved ≤2 issues. This remedial work often involved a veterinarian (14/30) or allied health practitioner (6/30). Most horses were hot shod (67/89) with conventional fullered shoes. Uneven feet were identified in 16 of 89 horses but were not positively associated with inability to train, possibly reflecting the minor variation between feet. Uneven feet were associated with variation in heel length and angle measurements and a greater sole length and reduced sole width, rather than smaller and boxy. Multiple correspondence plots identified an association of uneven feet with the dressage horses rather than show jumping horses.



## 1. Introduction

Irrespective of the equestrian sport, or the country of the participant, the median competitive (registration) life of the equine athlete is reported to be between 3 and 4 years [1–4]. This represents a short career relative to the time required for development and training of the sport horse and the financial investment involved. After lack of talent, the major reason for loss of horses from sport is musculoskeletal injury. Musculoskeletal injury can be mitigated by proactive and reactive changes in the management of the equine athlete [5]. Both proactive and reactive strategies require an understanding and description of the production process so that variables for modification can be identified.

There is a strong positive association of early introduction to training and sport and career longevity and success [6,7]. Within the equestrian sport literature, there appears to be limited data on the age when horses are first introduced to ridden work and the initial training process in relation to loading of the musculoskeletal system. It appears that older horses have a greater risk of lost training days than younger horses aged ≤6 years, although these data are confounded by competition level and older horses

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having a greater relative workload (longer training time and increased complexity of tasks) [8,9].

Data from cross-sectional surveys have identified an interaction of surface type and management on the risk of injury [10]. Some sport-specific injuries have been proposed to be the interaction of repetitive loading and consistent exposure to the same surface [11]. Cross-training, or variation in training, may provide a necessary variation in the nature of the load cycles the limb is exposed to as variation in training has been positively associated with a reduced risk for days lost from training [10,12]. However, this is confounded with data on specificity and consistency of surfaces. Although sand arenas were identified with an increased risk of lameness, increased number of days per week trained on a sand arena reduced risk of lameness in dressage horses [10]. These data highlight our lack of quantification of the appropriate number of load cycles required on different surfaces and with the differing activities to optimize tissue response.

The hoof responds dynamically to load, and there may be a genetic component to hoof conformation [13]. It has been proposed that laterality in the young foal may predispose it to asymmetrical hoof size and shape, and a positive association between lateral preference and asymmetrical feet has been documented [14]. Laterality appears to persist in racehorses during training [15] and has been observed as differences in hoof circumference and bone mineral density between forelimbs [16,17]. Within the Dutch Warmblood population, ~8% of horses present with asymmetrical forefeet (different size or shape) and a trend for mildly narrow feet with lower heel height. However, the association of lower scores in foot conformation and asymmetrical forefeet with a shorter registration life was only significant between elite and basic-level show jumpers but not within dressage horses [1]. These data imply that the consequences of poor hoof conformation increases with the magnitude of the load imposed during training and competition. There appears to be limited data for other populations of sport horses, and none for cohorts of sport horses predominantly kept at pasture.

Within New Zealand, there are limited data on the feeding and management of sport horses [18]. The preliminary data indicate that the management of the horses differs from the published European data and hence raises the question as to what, if any, effect this has on the type of, and rates of injury observed. Within this population, it is proposed that the primary reasons for wastage after lack of talent are lameness and orthopedic injuries [3,19]; however, we are currently lacking data to support or quantify this assumption.

The objective of this study was to obtain preliminary data on farriery and hoof care practices and owner-reported injury within a cohort of show jumping and dressage horses in New Zealand.

## 2. Materials and Methods

### 2.1. 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 two competitive riders with multiple horses. 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.

### 2.2. Questionnaire Design

The questionnaire 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). Lameness or injury was reported if it resulted in an inability to train for $\geq$7 days, in line with reporting practice used with Thoroughbred racehorse training studies [20,21].

### 2.3. Hoof Measurement

For each horse, digital images were obtained of the forelimbs and hoof sole using compact digital cameras (Nikon Coolpix S6300). For each horse, lateral and solar views of each hoof were obtained with the camera at a focal distance of approximately 1 m. 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 the object for calibration for subsequent image analysis.

Data were collected using a measurement protocol modified from a previous study (Fig. 1) [22] and using measurement parameters previously used to describe hoof asymmetry [23]. In brief, digital images were uploaded into ImageJ V1.44 (National Institute of Health) for linear and angle measurements. Measurements were made of the dorsal hoof wall angle (DHA) and length, coronary band length, dorsal coronary band height, 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 (width of the hoof at its widest point), hoof length (length of the solar ground bearing surface), frog length (the distance from the buttress of heels/palmar hoof line to the point of frog), and distance from the widest point of the hoof to the most caudal solar surface (buttress of heel/palmer hoof line; Fig. 1). Within-operator trials based on five repeated measurements per parameter demonstrated high repeatability of measurement with coefficients of variation below 2%.