

Locomotor injuries morbidity data analysis in Chilean sport horses: a retrospective study (2016-2021)

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ABSTRACT. The equine industry in Chile is small but constantly growing, being the Chilean Rodeo the most important discipline. Problems associated to the musculoskeletal system are the most frequent condition in the equine veterinary practice. Economic losses for the equine industry associated to injuries related to the locomotor system are significant and have been estimated in different parts of the world. Five hundred and eighty-one (581) Chilean purebred horses (Caballo Raza Chilena) performing or training for Chilean Rodeo discipline fulfilled the inclusion criteria. Results showed that in Chilean purebred horses, forelimbs injuries were recorded in 73.1% and hindlimbs 26.9% being a statistically significant difference ($P = 0.001$). Unilateral lameness was the most frequent situation seen in 74.9% ($n=424$), bilateral lameness was observed in 21.7% ($n=102$) and lameness in 3 or more areas was recorded in 9.5% of horses ($n=55$). When comparing frequency of distribution between right and left sides, no differences were observed between forelimbs ($P = 0.645$) or hindlimbs ($P = 0.853$). The forelimb digit (hoof, pastern, and fetlock) had a prevalence of 59.6%. When specific diagnoses were recorded the most prevalent causes of lameness in Chilean purebreds were navicular disease (12.9%), fetlock osteoarthritis (11.9%) and distal tarsal joints osteoarthritis (11.7%). In conclusion, due to the activity and specific physical demands suffered by Chilean Rodeo horses, veterinarians must be familiar with injuries affecting Chilean sport horses, as the morbidity of musculoskeletal injuries varies drastically between different disciplines.

Key words: musculoskeletal, horses, Chilean purebred, forelimb, digit.

INTRODUCTION

The horse industry in Chile is mostly supported by the Chilean Rodeo, a discipline solely practiced by Chilean purebred horses (Caballo Raza Chilena), the most popular breed of horses in Chile. Problems associated to the musculoskeletal system are well known to be the most frequent condition in the veterinary practice (Egenvall *et al.*, 2005; Penell *et al.*, 2005) and the Chilean purebred is not the exception. Most epidemiological studies have focused in the Thoroughbred racing industry (Barroeta *et al.*, 2019; Ramzan & Palmer, 2011; Morales *et al.*, 2009, 2018) although a few recent studies have analysed different populations of horses (Dabareiner *et al.*, 2005a, 2005b; Dyson, 2000; Egenvall *et al.*, 2009; Fortini, 2011; Jackman, 2001; Lewis, 2001).

Economic losses for the equine industry associated to injuries related to the locomotor system are significant and have been estimated in different parts of the world (Seitzinger *et al.*, 2000; Egenvall *et al.*, 2006; Egenvall *et al.*, 2009). However, in Chile, there is still scarce information on this subject. Although the equine industry in Chile is small, it is constantly growing and the most important discipline in the country is the Chilean Rodeo. Only one study focused on the epidemiology of the main injuries of

the locomotor system in Chilean Rodeo horses has been published (Mora-Carreño *et al.*, 2014).

Understanding the biomechanics and demands of each discipline is extremely important to understand the pathophysiology of the specific injuries, as a basis for prevention of lesions in the equine athlete. Moreover, proper knowledge of biomechanics of a specific discipline directly aids the clinician in achieving a proper diagnosis and establishing a correct treatment plan when lameness is present. The Chilean Rodeo is a highly demanding discipline in which biomechanics forces predisposed to an increased stress to different joints and soft tissues such as metacarpophalangeal joint, distal interphalangeal joint, distal tarsal joints, and collateral ligaments. Thus, the aim of this study was to conduct a new morbidity data analysis with a larger cohort of Chilean sport horses to elucidate the most common conditions causing lameness in this breed of horses.

MATERIAL AND METHODS

Data was gathered from the medical records from horses presented to Equestria Equine Medical Center, located in Quillota, Chile, between the years 2016 and 2021. Medical records from eight hundred and ninety horses (890) diagnosed with an associated musculoskeletal injury with an age ranging from 3-18 years-old were included in this study for morbidity analysis. Horses diagnosed with a locomotor problem associated with the head and neck such as temporomandibular joint, cervical spine stenosis or cervical facet conditions were excluded from the analysis. From the eight hundred and ninety horses that fulfilled the inclusion criteria, six hundred and thirteen (613) were Chilean purebred horses performing or training for Chilean

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Rodeo discipline from which thirty-two horses (32) were excluded because the diagnosis was associated to a neck or head problem giving a total of 581 Chilean horses finally included in the morbidity analysis. Information obtained from clinical records included: name, age, gender, affected limb(s), and diagnosis. Horses with any missing information mentioned above were excluded from the analysis.

Statistical analyses were run on SPSS, version 19 for Windows (SPSS Inc, Chicago IL, USA). Frequencies were calculated for description of the qualitative data and for quantitative variables a descriptive statistical analysis based on mean and standard deviation was performed. Additionally, qualitative data was analysed with the non-parametric Pearson Chi-square test to determine differences between lameness distribution. The significance level was set at $P < 0.05$.

RESULTS AND DISCUSSION

From a total of 890 medical records gathered from horses diagnosed with one or more locomotor injuries, 68.9% were Chilean purebred horses, 25.3% Warmbloods, 2.6% Thoroughbreds, 2.4% Polo horses, 0.8% Arabians, 1% Crossbred and 0.9% Quarter horses (Table 1). Records obtained from Chilean purebred horses examined ($n = 581$) showed an average age of 10.78 ± 3.15 years distributed in geldings ($n = 291$, 50.1%), mares ($n = 199$, 34.3%), and stallions ($n = 91$, 15.7%). The information presented regarding horse breeds diagnosed in our hospital, shows a clear predominance of Chilean Horses; nonetheless, the breed is probably overrepresented, and this distribution might vary between veterinarians and veterinary practices. Forelimbs injuries were recorded in 72.9% of cases and hindlimbs injuries in 27.1% of cases, with a statistically significant difference among them ($P = 0.001$). Unilateral lameness was the most frequent situation seen in 74.9% of cases ($n = 424$), bilateral lameness was observed in 21.7% ($n = 102$), and lameness in 3 or more areas was recorded in 9.5% of horses ($n = 55$). Several publications in different breeds have shown that the distribution of lameness is most prevalent in the forelimbs than the hindlimbs (Barroeta *et al.*, 2019; Dabareiner *et al.*, 2005a; Dabareiner *et al.*,

2005b; Mora-Carreño *et al.*, 2014; Morales *et al.*, 2009). This differences in lameness distribution between forelimbs and hindlimbs in most equine disciplines is explained by the body-weight distribution, of approximately of 60% on the forelimbs (Hood *et al.*, 2001). This is similar to what we observed in our study where 72.9% of lameness were located in the forelimbs. This could be explained by different factors such as horse body conformation (muscled but small horse, height < 145 cm to the withers, relatively short limbs, with small hooves, and weighting ≤ 370 kg), poor hoof balance often seen in Chilean horses and increase in body-weight distribution on forelimbs related to heavy riders (> 80 kg).

When comparing frequencies of distribution between right and left sides, no differences were observed between forelimbs ($P = 0.645$) or between hindlimbs ($P = 0.853$). The most frequently affected areas were the fore hoof (33.2%), fore fetlock (20.2%), hock (13.8%) and fore pastern (8.0%). According with this data, the forelimb digit (hoof, pastern, and fetlock) had a prevalence of 61.4%. This percentage coincides with what has been described in previous studies in different breeds such as Quarter Horses used for western performance (Dabareiner *et al.*, 2005a; Dabareiner *et al.*, 2005b). This similarities in forelimb digit lameness prevalence might be due to similar body conformation between the Chilean purebred and Quarter horses, an even if the Quarter Horse is a larger horse, their proportions are alike. Similarly to the Chilean Rodeo, western performance horses are under a very strenuous demands in the fore digit joints and hock because of sudden movements of accelerations, turns and stops at high speed during competition (Jackman, 2001; Lewis, 2001; Dabareiner *et al.*, 2005a; Dabareiner *et al.*, 2005b).

When specific diagnoses were recorded, the most frequent causes of lameness in Chilean purebred horses were navicular disease (12.9%), fetlock osteoarthritis (11.9%) and distal tarsal joints osteoarthritis (11.7%). The recorded diagnoses are shown in table 2. Navicular disease is a common condition in all breeds and in the Chilean purebred is one of the most prevalent condition (Mora-Carreño *et al.*, 2014). Accordingly, in our report, navicular disease was recorded as the most prevalent affection in the

Table 1. Breed distribution from horses diagnosed with one or more locomotor injuries between the years 2016-2021 (before exclusion of diagnosis including head and neck problems).

| Breed | N | % | Mean age \pm SD |
|------------------|-----|------|-------------------|
| Chilean purebred | 613 | 68.9 | 10.78 \pm 3.15 |
| Warmblood | 209 | 23.5 | 11.52 \pm 3.98 |
| Thoroughbred | 23 | 2.6 | 5.45 \pm 3.03 |
| Polo Horse | 21 | 2.4 | 12.24 \pm 2.43 |
| Arabian | 7 | 0.8 | 7.86 \pm 3.58 |
| Crossbred | 9 | 1.0 | 14.44 \pm 3.74 |
| Quarter horse | 8 | 0.9 | 9.38 \pm 2.87 |
| Total | 890 | 100 | |

Table 2. Musculoskeletal diagnoses from Chilean purebred horses (n=581) obtained from records between the years 2016-2021.

| Limb (n, %) | Area (n, %) | Recorded Diagnosis (n, %) |
|---|---|---|
| Forelimbs (n=424, 72.9%) | Hoof (n=194, 33.2%) | Navicular disease (n=75, 12.9%) |
| | | DIP osteoarthritis (n=22, 3.7%) |
| | | Laminitis (n=21, 3.6%) |
| | | Solar contusion (n=18, 3.2%) |
| | | Collateral ligament desmitis (n=17, 3.0%) |
| | Pastern (n=46, 8.0%) | Hoof abscess (n=15, 2.5%) |
| | | Others (n=26, 4.4%) |
| | | DDFT (n=18, 3.2%) |
| | Fetlock (n=118, 20.2%) | PIP osteoarthritis (n=15, 2.5%) |
| | | PIP subluxation (n=5, 0.9%) |
| Others (n=8, 1.4%) | | |
| Fetlock osteoarthritis (n=70, 11.9%) | | |
| Cannon/Carpus (n=57, 9.9%) | Fetlock osteochondral fragment (n=19, 3.4%) | |
| | Collateral ligaments (n=8, 1.4%) | |
| | Others (n=21, 3.6%) | |
| | Suspensory Desmitis (n=16, 2.8%) | |
| Elbow/Shoulder (n=9, 1.6%) | Carpus OA (n=16, 2.8%) | |
| | Splint bones fracture (n=11, 1.8%) | |
| | SDFT (n=5, 0.9%) | |
| | Others (n=9, 1.6%) | |
| Hindlimbs (n=157, 26.9%) | Hoof (n=2, 0.4%) | Elbow/Shoulder Trauma (n= 4, 0.6%) |
| | | Shoulder osteoarthritis (n=2, 0.4%) |
| | Pastern (n=17, 2.9%) | Elbow osteoarthritis (n=1, 0.2%) |
| | | Others (n=2, 0.4%) |
| | | Hoof abscess (n=2, 0.4%) |
| | | PIP osteoarthritis (n=5, 0.9%) |
| | Fetlock (n=26, 4.4%) | P1 - P2 fracture (n=4, 0.6%) |
| | | Plantar pastern queloid (n=3, 0.5%) |
| | | Others (n=4, 0.6%) |
| | Cannon/Hock (n=80, 13.8%) | Fetlock osteoarthritis (n=8, 1.4%) |
| Fetlock osteocondral fragment (n=6, 0.9%) | | |
| Collateral ligaments (n=4, 0.6%) | | |
| Others (n=8, 1.4%) | | |
| Stifle (n=19, 3.4%) | Hock osteoarthritis (n=68, 11.7%) | |
| | Suspensory Ligament desmitis (n=6, 1.1%) | |
| | Others (n=6, 1.1%) | |
| | Stifle osteoarthritis (n=8, 1.4%) | |
| Thoracolumbar spine/pelvis (n=13, 2.2%) | Medial femoral condyle cyst (n=2, 0.4%) | |
| | Upward fixation of the Patella (n=2, 0.4%) | |
| | Others (n=6, 1.1%) | |
| | | Kissing Spines (n=7, 1.2%) |
| | | Coxo femoral osteoarthritis (n=2, 0.4%) |
| | | Others (n=3, 0.5%) |

Chilean horse, which could be related, among other things, to the discipline itself strenuous demands to anatomical structures within the hoof capsule. The biomechanical forces applied to the navicular bone due to its anatomical location between the third phalanx, second phalanx, and

the deep digital flexor tendon (DDFT) are enormous and it has to withstand great forces, in particular during the propulsive phase of the stride when there is a greater tension of the DDFT (Rijkenhuizen, 2006; Dörner *et al.*, 2017). Other factors that could be related with the high

prevalence in the Chilean horses are the small hooves and narrow heel bulbs characteristic in this type of breed, which could impair the normal physiology and distribution of biomechanical forces inducing more stress to the inner structures within the hoof capsule. Additionally, there are genetic factors involved and it has been reported that the shape of the proximal articular border of the navicular bone has been found to be inherited and to predispose to the pathogenesis of navicular disease (Rijkenhuizen, 2006). Many different diagnoses were recorded in our data morbidity analysis and that is mostly due to the advancements in the diagnostic techniques and imaging technologies significantly improving the specificity and diagnostic accuracy. Digital radiography (RX) and high-definition ultrasonography (US) are both widely available in our country for the diagnose of most osteoarticular (osteoarthritis, osteochondral fragments, bone remodelling, fractures, among others) and soft tissue injuries (tendons, ligaments, muscles, and articular), respectively. Recently, magnetic resonance imaging (MRI) became available in Chile improving even more the diagnostic capabilities and enabling the diagnosis of injuries not detected by conventional imaging modalities. However, other imaging modalities such as computed tomography (CT) and gamma scintigraphy (bone scan) are not readily available in Chile, but efforts should be made to offer these advanced imaging modalities to the Chilean equine industry. Although there is one study published related to musculoskeletal injuries in Chilean Rodeo horses (Mora-Carreño *et al.*, 2014), our study has a larger number of animals, being a better representation of the main locomotor injuries in purebred horses and enriching the scarce information available on pathologies causing poor performance and lameness in Chilean Rodeo horses.

In conclusion, the most prevalent conditions observed in Chilean Rodeo horses in this study were navicular disease (12.9%), fetlock osteoarthritis (11.9%) and distal tarsal joint osteoarthritis (11.7%). The above is due to the specific biomechanical forces and strenuous physical demands of the Chilean Rodeo horses, consequently veterinarians must be familiar with injuries affecting the Chilean horse and imaging modalities available for diagnosis of each specific injury, as the morbidity of musculoskeletal injuries varies drastically between different disciplines. The above, is important to establish preventive measures, especially focused to hoof trimming and shoeing to diminish the biomechanical strenuous forces to the structures most frequently affected.

COMPETING INTERESTS STATEMENT

The author declare that he does not have competing interests.

ETHICS STATEMENT

No experimental animals or animals for clinical research were used in this study.

AUTHOR CONTRIBUTIONS

CD participated in the design, data gathering, data analysis and writing of the manuscript.

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