Proceedings of the European Veterinary Conference Voorjaarsdagen

Amsterdam, the Netherlands
Apr. 17 - 19, 2014

Next Meeting:
April 9-11, 2015
Amsterdam, the Netherlands

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THE VETERINARY DISCIPLINARY BOARD, AN INCREASING PROBLEM FOR THE DUTCH EQUINE PRACTITIONER?

Introduction
The Veterinary Disciplinary Board (VDB) is an independent court of justice and was set up in The Hague in 1992 in accordance with the Veterinary Practice Act to improve the quality of veterinary practice. The aim of the present study was to objectively assess the perception over recent years that both owners of horses and the national veterinary complaint officer (NVCO) have submitted more cases for consideration by the Board and to study the content of the complaints.

Materials and methods
All equine cases submitted between July 1 2008 and July 1 2013 were evaluated using the published data of the VDB to study the complaints and to compare these to the results of an earlier study.

Results
Over the five year period 80 equine cases were submitted; 71,2% complaints were submitted by owners and 28,8% by the NVCO. The main underlying reasons were problems relating to treatment (45), prepurchase examinations (9), veterinary prescriptions (13), veterinary medicines (8), owner trust compromised (2), incorrect evaluation of negligence (2) and incorrect micro-chipping (1). The decisions of the VDB were that the complaint was not acceptable (1), the VDB was not competent to make an assessment (2), the complaint was illegitimate (30), and in 47 submissions the complaint was considered legitimate. The sanctions in these 47 legitimate complaints were: no action (1), warning (21), reprimand (6), conditional fine (4), fine (15). Several of the latter 47 cases were appealed by the Veterinary Vocational College and an additional eight of these were then considered to be illegitimate.

Discussion and conclusion
Compared to an earlier study the number of equine complaints has increased: from 9,2/year between 1992-2005 (Hilhorst et al. 2007) to 16/year between 2008-2013. The percentage of cases submitted by the NVCO has also increased (5,5% against 28,8%).

Reference
HORSE’S FETLOCK ANGULAR BEHAVIOR ANALYSIS THROUGH INTRA CLASS CORRELATION (ICC)

Introduction
Direct visual observation not always allows identification of subtle changes on horse’s locomotion pattern. 3D biomechanics horse model plays an important role, quantifying selected kinematic variables. This study aims to quantify the consistency of fetlock’s angular behavior between forelimbs and between hindlimbs, and the similarity of the fetlock’s absolute angular values between forelimbs and between hindlimbs.

Material and Methods
3D fullbody equine model, with 106 retroreflective markers representing 25 segments, 9 Vicon® cameras (250Hz) and Nexus® software were used in a Selle Français, hand walked in 7x1.5x3m capture volume. 20 valid trials were collected with necessary data to compute the horse’s kinematic angular parameters in a complete stride, totaling five strides per limb. Kinematic data were interpolated for 101 samples, using 5th order spline. For each limb, values were averaged for every 1/100th of the stride. Consistency and agreement averaged values were calculated for the sagittal plane, for forelimbs and for hindlimbs using ICC (p<0.01).

Results and Conclusions
Data presents similar behavior throughout the stride between forelimbs and between hindlimbs, namely, a fetlock’s behavior consistency between forelimbs (ICC = 0.996) and between hindlimbs (ICC = 0.993). Data shows high similarity in the absolute values registered in forelimbs (ICC = 0.990) despite the lower similarity in hindlimbs (ICC = 0.790). Although ICC values for absolute agreement are considered good1, above 0.700, there is a big difference when comparing the hindlimbs values (0.790) with the forelimbs (0.990), proving a different behavior in the fetlock. Nevertheless ICC for consistency is quite similar which shows that the methodology applied is appropriate for the quantification of discrepancies between collected data.

Work supported by the Portuguese Foundation for Science and Technology, FCT/TDC/CVT/113480/2009: Equine biomechanics: kinematic and dynamometric analysis of the normal equine locomotion and comparison of the effect of different conformation and orthopedic treatments.

ATRIAL NATRIURETIC PEPTIDE AS AN INDICATOR OF THE SEVERITY OF VALVULAR REGURGITATION AND HEART FAILURE IN HORSES

Background
Natriuretic peptides are cardiac biomarkers that have been shown to have high potential for diagnosis, prognosis, and guidance of treatment in human and small animal cardiology. However, their diagnostic and prognostic value in the equine species have only been studied in a limited number of cases.

Objective
To investigate the plasma atrial natriuretic peptide concentration (ANPPl) in a large group of horses with various degrees of valvular regurgitation (VR) and heart failure (HF).

Animals
Ninety-one horses, admitted at the equine teaching hospital of the University of Liege, and with no, mild, moderate or severe VR and presenting various stages of HF, according to human and canine grading system (A: no VR, B1: asymptomatic VR without cardiac remodelling, B2: asymptomatic VR with cardiac remodelling, C: symptomatic VR).

Methods
All horses underwent clinical and Doppler echocardiographic examination, which allowed determining the presence, nature, and severity of VR, and the HF stage. The ANPPl was measured using a commercially available human RIA test. The mean values of body weight, age, ANPPl and each echocardiographic parameter were compared between horses in stage A, B1, B2 or C of HF and between horses with no, mild, moderate or severe VR, using a one-way ANOVA test. Then, correlations between ANPPl and each echocardiographic parameter were assessed using a Pearson's product-moment analysis.

Results
Horses with severe and moderate VR had significantly higher ANPPl than horses with mild or no VR. ANPPl was significantly higher in horses at stage B2 and C of HF than horses at stage A and B1. Moreover, ANPPl was significantly correlated with most of the measured echocardiographic variables. This correlation was especially strong with the left atrial diameter and its percentage of dilation.

Conclusions and Clinical Importance
These results suggest that ANPPl in horses suffering from VR could have a high diagnostic value of HF, especially in horses with tricuspid or mitral insufficiency and with enlargement or dysfunction of the atria.
CHEEK TOOTH REMOVAL AFTER COMPLETE CROWN FRACTURE IN 20 HORSES

Introduction
The extraction of equine cheek teeth is a frequent procedure in veterinary practice. After fracture of the dental crown the classical transoral approach often fails. Alternative ways of tooth removal therefore are necessary.

Aim
The aim of the case series was to describe alternatives to the conventional transoral approach for tooth removal. This case series focuses on dental screw extraction or tooth fragmentation after a minimally invasive transbuccal approach and tooth repulsion.

Material and Methods
20 horses (4-26 years of age) with a coronal fracture of a cheek tooth were included. Radiographic examination of the skull and oral endoscopy were performed in all horses, and computed tomography was conducted in one case.

Results
Thirteen maxillary (from 08 to 10) and seven mandibulary (from 07 to 10) cheek teeth with completely fractured crowns were removed in 20 horses. 18/20 horses were treated via buccotomy: 16/18 minimally invasive, 1/18 through a bony approach and 1/18 with an extended minimally invasive buccotomy. Screw extraction was successful in 5/18 horses. In 4/18 cases fragmentation of the tooth was necessary and 9/18 required a combination of both techniques. Repulsion of the diseased tooth over a pre-existing fistula was successful in 2/20 horses. The teeth were removed under standing sedation (n=16) or general anaesthesia (n=4). All horses recovered uneventfully from surgery. Complications occurred in 2/20 horses intraoperatively (bleeding from palatine artery or buccal artery) and in 4/20 horses during the postoperative period (infection of the buccotomy approach [n=2], sequestration of the alveola [n=2]). All cases returned to normal work within 2-8 weeks.

Conclusion and clinical relevance
This case series shows various alternatives of cheek tooth removal in cases with coronary fractures. With appropriate treatment and a combination of different surgical techniques the success rate was good even in cases considered to be difficult.

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SUCCESSFUL CLOSED REDUCTION OF AN ATLANTOAXIAL LUXATION IN A DUTCH WARMBLOOD GELDING WITH LONG-TERM FOLLOW-UP

Introduction
Atlantoaxial luxation is a rare condition in horses, in adult horses mostly due to trauma. Successful reduction has only rarely been reported. In this report we will present an approach, which has been successful in our case.

Material and Methods
A 4-year-old Dutch Warmblood gelding was presented in our clinic with severe ataxia and an abnormal head-neck positioning after a traumatic riding accident. After a full clinical and a radiographic examination an atlantoaxial luxation was diagnosed. A closed reduction using a combination of traction and manual manipulation (in hyperextension) was initiated under fluoroscopic guidance. Follow-up radiographs were taken after 1 day, 1 week, 2 months, 6 months, 1.5 years and 5 years.

Results
The horse recovered well and was sound after a few weeks. The initial radiographs showed a malalignment at the level of C1-C2, with the dens of C2 being displaced ventral to a dorso-caudal rotated C1. After reduction a normal alignment of C1-C2 and a correct positioning of the dens were radiographically confirmed. Follow-up radiographs showed a progressive mineralisation cranio-dorsally of the dens. After the recovery period, the horse has not shown clinical problems related to the atlantoaxial luxation anymore and has been competing successfully up to the level of 2*-eventing competitions.

Conclusions
The technique used in this case has not been described in literature. The manual manipulation in hyperextension allows reducing the linear traction needed to be able to reposition the dens of C2 in its normal position. More cases and further research comparing the different techniques will be needed to allow validation of this new technique.
SYMPATHETIC INNERRVATION AND ADRENERGIC RECEPTORS IN THE EQUINE DEEP DIGITAL FLEXOR TENDON

Introduction
The aim of this study was to delineate the sympathetic innervation pattern in healthy equine deep digital flexor tendon (DDFT) in the digit, via immunohistochemical stainings (IHC) for tyrosine hydroxylase (TH) and alpha-1 adrenergic receptor (α1-AR), and to assess the normal microanatomy of DDFT correlated with the immunohistochemical stainings.

Materials and Methods
Fourteen feet selected from 10 horses without history of forelimb foot pain were used. The animals were humanely euthanized for reasons not related to this study. Longitudinal sections of the suprapseamoidean region of DDFTs were harvested. The DDFT sections were divided into different microanatomical zones, from dorsal to palmar. IHC against TH was performed using anti-human monoclonal antibody validated for equine tissues. IHC against α1-AR was performed with an anti-human polyclonal antibody; we personally validated for equine tissues using western blotting technique. In both the IHC evaluations, equine midbrain was used as a positive control, while negative controls were performed using the same protocol without the primary antibody.

Results
The suprapseamoidean part of the DDFTs appeared to be composed by three different zones. The zone 1 represented the dorsal layer, was composed of dense irregular connective tissue and was relatively hypovascular (fibrocartilage). Zone 2 consisted of dense regular connective tissue and tenocytes and showed an extensive interfascicular vascular network distributed in endotendon loose connective tissue. Zone 3 represented the palmar layer consisting of dense connective tissue rich in blood vessels. Most of the sympathetic innervation was detected proximal to or in the walls of blood vessels. The zone 2 was sparsely innervated, and a lesser degree of innervation was detected in zone 1. The α1-AR immunoreactions were also detected in the walls of blood vessels and in the spindle cells of zone 1, which showed intense cytoplasmatic immunostaining. Both α1-AR and TH immunostaining were detected in tenocytes.

Conclusion
The DDFT expresses a well-defined pattern of sympathetic innervation. These findings provide insight into autocrine/paracrine catecholaminergic system in tendon tissue. Knowledge of the pattern of sympathetic innervation in the healthy equine DDFT might aid investigations of the pathogenesis of degenerative changes in tendinosis.

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ENERGY METABOLISM REGULATION IN DONKEYS

Introduction
Donkeys are commonly afflicted by endocrine and metabolic disturbances but scarce studies have been focused on the hormonal control of energy metabolism and its association with morphometric indices, age or gender in this species. Numerous differences have been established between donkeys and horses, therefore considering both species metabolically and endocrinologically similar could lead to erroneous diagnostics.

Aim of the study
A) to determine plasma concentrations of glucose, triglycerides, insulin, glucagon, leptin, adiponectin, ghrelin and insulin-like growth factor 1 in healthy donkeys, and B) to study the associations between these parameters and morphometric variables, age and gender.

Materials and methods
Blood samples were collected from 62 healthy donkeys, with a mean age of 6.8±0.6 years and a mean weight of 267.4±10.6 kg. All hormone concentrations were measured by radioimmunoassays, and glucose and triglyceride concentrations by spectrophotometry. The following body measurements were taken and calculated on every animal: weight, height at the withers, length, girth, neck circumference, body mass index and neck circumference to height ratio.

Results
Insulin, glucagon, leptin and IGF-1 concentrations were similar compared to other species, however, adiponectin and active ghrelin concentrations were lower in donkeys than horses and human beings. Donkeys with larger neck scores and body mass indices had higher triglyceride, leptin and IGF-1 concentrations. A sexual dimorphism was observed on all morphometric measurements and plasma glucose concentrations independent of adiposity. Younger animals had lower morphometric measurements, triglycerides and leptin concentrations.

Conclusions
This study suggests inter-species differences between energy metabolism and endocrine factors. In addition, it is the first one evaluating the association of these endocrine factors with morphometric measurements, age and gender in donkeys.

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BLOOD GLUCOSE HOMEOSTASIS IN DONKEYS: INTRAVENOUS GLUCOSE AND COMBINE GLUCOSE-INSULIN TESTING.

Introduction
Donkeys have a similar predisposition to insulin resistance as horses. Intravenous glucose tolerance test (IGTT) and combined glucose-insulin test (CGIT) are widely studied in horses, but whether these dynamic tests could be interpreted in a similar way in donkeys is unknown, since both tests have not been studied in donkeys yet.

Aim of the study
To characterize IGTT and CGIT in healthy adult donkeys.

Materials and methods
Ten donkeys (7.1±0.8 years old) with a weight of 282±12.4 Kg were used. Tests were carried out in overnight fasted donkeys as previously described for horses. Briefly, CGIT was performed administrating 150 mg/kg glucose followed by 0.1 IU/Kg of insulin. For IGTT, 300 mg/kg glucose was administered intravenously in bolus. The following parameters were calculated from the curves: positive phase duration (PPD), positive phase glucose clearance rate (PGCR), time to nadir (TN), negative phase duration (NPD), negative phase glucose clearance rate (NGCR), glucose area under curve (AUCg) and insulin area under curve (AUCi). Plasmatic glucose concentration was determined by spectrophotometry and insulin concentration by radioimmunoassay.

Results
Donkeys showed a right-shift of the CGIT curve compared to horses, with PPD (44.1±3.1 min), TN (118.3±6.4 min) and NPD (255.9±3.2 min) higher than horses. PGCR and NGCR were lower in donkeys (1.9±0.2 and 0.6±0.1 mg/dL/min respectively). AUCg and AUCi (15.2x10^3 and 13.2x10^3 mg/dL/min, respectively) were higher in donkeys than horses. IGTT curve also was right-shifted in donkeys, with PP (44.1±3.1 min), TN (118.3±6.4 min) and NPD (255.9±3.2 min), higher than horses. PGCR and NGCR were lower in donkeys (1.9±0.2 and 0.6±0.1 mg/dL/min respectively). AUCg and AUCi (15.2x10^3 and 13.2x10^3 mg/dL/min, respectively) were higher in donkeys than horses.

Conclusions
Results from CGIT and IGTT in donkeys should be interpreted cautiously since differences with horses have been demonstrated in this work. Extrapolating data from horses, donkeys could be erroneously considered as insulin resistant. This work is the first studying glucose homeostasis via CGIT and IGTT in donkeys.

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ULTRASONOGRAPHIC ASSESSMENT OF SUBCUTANEOUS FAT THICKNESS AND ITS RELATIONSHIP WITH BODY SCORING SYSTEMS AND PLASMA ADIPOKINES IN ANDALUSIAN HORSES

Introduction
Body scoring systems provide subjective adiposity measurements, influenced by biased factors such as scorer experience, horse breed or local fat deposits (1). Ultrasonographic fat thickness measurements have been proposed as the most accurate objective method for measuring subcutaneous fat distribution in live horses (1).

The aims of this study were to determine the relationship among Body Condition Score (BCS), Cresty Neck Score (CNS), ultrasonographic measurements of subcutaneous fat thickness (SFT), plasma leptin and triglycerides in Andalusian horses.

Material and Methods
Forty six barren mares and sixty nine Andalusian stallions (2-15 years) were studied. BCS (2) and CNS (3) were estimated. SFT at four corporal regions (rump, tailhead, 12-13th ribs and behind the shoulder) was measured by ultrasonography in each animal. Obesity was defined as BCS≥7 and CNS≥3.

Blood samples were collected between 06:00 and 12:00h, withholding concentrate at least 12h. Leptin and triglycerides were analyzed in plasma.

Statistical analyses were performed by Student’s T test or Mann-Whitney U test and, correlations by Spearman or Pearson tests.

Results
Obese horses had higher concentrations of leptin, triglycerides and SFT behind the shoulder, at rump and tailhead than non-obese horses (Table 1).

BCS was positively correlated with CNS, leptin, triglycerides and SFT at every location measured. SFT at tailhead was the parameter most positively correlated followed by CNS and leptin. The rest of SFT measurements corresponded with low coefficients of determination,

CNS was correlated with triglyceride levels and, SFT at 12-13th ribs, behind the shoulder and tailhead.

Leptin values were correlated with triglycerides and, SFT at the rump, tailhead and 12-13th ribs.

No association between triglycerides and any SFT measurement was found.

Conclusion
BCS is a practical, quick, and easy technique for obesity assessment in equids; however in Andalusian horses, is not strongly correlated with some objective parameters that characterize the obesity condition in other breeds as triglycerides and SFT measurements. Therefore, objective parameters such as leptin and SFT at the tailhead are recommended to complete the evaluation of obesity in this breed.

References
### Tables

Table 1. Comparison of studied variables (mean ± standard deviation) between obese and non-obese horses

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Obese (n=29)</th>
<th>Non-obese (n=86)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCS</td>
<td>7.31 ± 0.47</td>
<td>5.60 ± 0.85</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>CNS</td>
<td>3.62 ± 0.41</td>
<td>3.06 ± 0.85</td>
<td>0.001</td>
</tr>
<tr>
<td>Behind shoulder</td>
<td>8.34 ± 3.86</td>
<td>6.76 ± 2.82</td>
<td>0.048</td>
</tr>
<tr>
<td>12-13th ribs</td>
<td>8.34 ± 2.76</td>
<td>7.24 ± 2.55</td>
<td>0.052</td>
</tr>
<tr>
<td>Rump</td>
<td>16.52 ± 4.59</td>
<td>12.60 ± 4.48</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Tailhead</td>
<td>30.13 ± 7.99</td>
<td>20.34 ± 7.00</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Leptin</td>
<td>11.28 ± 5.39</td>
<td>6.05 ± 4.56</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>42.05 ± 26.04</td>
<td>30.60 ± 11.95</td>
<td>0.029</td>
</tr>
</tbody>
</table>

\(^1\) Significance of Student's t test; \(^W\) Significance of Mann Whitney U test. (Statistical significance was assumed if p<0.050)
ARE OBESITY SCORES ALWAYS CORRELATED WITH BASAL HYPERINSULINEMIA? AN EXPERIMENTAL STUDY IN ANDALUSIAN HORSES

Introduction
Andalusian horses exhibit a tendency toward obesity (1), predisposition to insulin-resistance (2) and however, little is known about the prevalence of basal hyperinsulinemia in this breed. These 3 characteristics, would determine its inclusion as risk breed for Equine Metabolic Syndrome.

The aims of this study were to determine the prevalence of obesity and hyperinsulinemia and, the association of insulin with different adiposity measurements in Andalusian horses.

Material and Methods
Fifty nine healthy Andalusian horses (21 mares, 38 stallions; 5 to 15 years of age) were studied. Pregnant and lactating mares were excluded.

Body Condition Score (BCS) (3), Cresty Neck Score (CNS) (4) and percentage of body fat (PBF) (5) were determined. Obesity was defined as BCS≥7 and CNS≥3, and hyperinsulinemia as plasma insulin ≥20µIU/mL.

For measurements of plasma insulin, leptin and triglycerides, grain was withheld for 12h and sampling was performed between 06:00 and 12:00am.

Statistical analyses were carried out by Student’s T test or Mann-Whitney U test, and Spearman’s coefficient test.

Results
Mean±SE of insulin, leptin, triglycerides and PBF were 5.43±5.64mU/L, 10.65±5.69 ng/mL; 38.77±27.87 mg/dL and 12.39±2.34% respectively, in obese horses.

Leptin (p=0.001) and PBF (p<0.001) values were greater in obese horses. There were no differences in insulin levels between obese and non-obese horses (p=0.144), however insulin was correlated with leptin values (rho=0.382, p=0.003).

The prevalence of obesity and hyperinsulinemia was 32.2% (95% CI: 21.69%; 44.90%) and 3.4% (95% CI: 0.93%; 11.54%) respectively, in all horses.

Conclusion
This work confirms the high prevalence of obesity in Andalusian horses; however, the prevalence of basal hyperinsulinemia was much lower than reported in other breeds (6). These results show that the relationship established between obesity scores and basal hyperinsulinemia as reported in other breeds (6,7) may not be applicable and should be adapted to Andalusian horses.

References

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CLINICOPATHOLOGIC FINDINGS IN HORSES WITH BI- OR TRIPARTITE NAVICULAR BONE

Introduction
A bi- or tripartite development of the navicular bone is a rare condition in horses and usually a coincidental finding at lameness or prepurchase examinations. The aim of this study was to compare the pathological examination of the partite navicular bone in the lame limb with the same location in the sound limb.

Materials and methods
In the period 2008-2011 three adult horses were referred for a chronic, recurrent lameness of respectively the left fore, the right fore and the left hind limb. All horses were clinically evaluated, with two horses becoming sound after a palmar digital nerve block; in one horse it was impossible to perform this nerve block due to non-cooperative behaviour. Based on radiographic examination these horses were all diagnosed with a bi- or tripartite navicular bone in the lame limb. Two horses were euthanized due to the given poor prognosis and pathological examination was performed; one horse was not available for follow up.

Results
The histological examination confirmed fibrous and cystic changes and cartilage retention in trabecular bone at the site of partition; the location of the defect (1/3 of the long axis of the bone) seemed to correspond with the site of blood vessel entry to the bone. However in both horses? In one horse? a similar partite navicular bone appearance was seen in the sound contralateral limb at the same location but without a cystic lesion.

Discussion and conclusions
Congenital partite malformation of the navicular bone histologically shows smooth, rounded adjacent edges of the bone. This could lead to a partitioned endochondral ossification and ultimately cystic changes of the bone which might cause clinical lameness. Further pathological research of the partite navicular bone is needed to provide better insight to the cause and possible consequences of this malformation.

References
RECENT ADVANCES IN EQUINE RHABDOMYOLYSIS IN ARABIAN HORSES: PRO-INFLAMMATORY CYTOKINES AND OXIDATIVE STRESS MARKERS

A total of 30 horses were divided into two groups, one served as a control whereas the other consisted of Rhabdomyolysis-affected horses. Blood samples were collected from diseased horses during the clinical episode of Rhabdomyolysis. After blood collection from both groups, the resulting sera were used for estimation of the activities of creatin kinase (CK), aspartate transaminase (AST), lactate dehydrogenase (LDH), lactic acid, triacylglycerol (TAG), glucose, total protein, albumin, globulin, urea, creatinine, Triiodothyronine (T3), calcium, sodium, potassium, phosphorus, chloride, vitamin E, interleukin-6 (IL-6) and tumor necrosis-α (TNF-α). In addition, whole blood was used for determination of selenium, reduced glutathione (G-SH) and prostaglandin F2-α (PGF2α). The erythrocyte hemolysates were used for the determination of the activities of superoxide dismutase (SOD), catalase (CAT), total antioxidant capacity (TAC), nitric oxide (NO) and malondialdehyde (MDA).

The present findings revealed a significant (p≤0.05) increase in the values of CK, AST, LDH, glucose, lactate, TAG, urea, creatinine, phosphorus, MDA, TNF-α, IL6 and PGF2-α in diseased horses when compared with the control. Furthermore, the values of calcium, SOD, CAT, TAC, NO and GSH in diseased horses were significantly (p≤0.05) lower than in the control group. The other examined parameters were not statistically significantly different.

In conclusion, the present investigation shed light on the possible role of proinflammatory cytokines and oxidative stress biomarkers in the pathophysiological mechanisms of Exertional Rhabdomyolysis in Arabian horses.

In the future, efforts should be made to confirm this in other breeds. If this could be achieved, it would open up new perspectives in research fields dealing with ER.

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BIOMECHANICS OF THE STALLION’S HINDQUARTERS DURING SEMEN COLLECTION

Introduction
It is often claimed that stallions used for both breeding and show-jumping perform less well in competitions during the breeding season. The demands on the back and pelvis during semen collection may impair the range of movement required for show-jumping. The aim of this study was to evaluate the range of motion (ROM) of a stallion’s hindquarters, in particular the degree of pelvic flexion (PF), during both the mounting and ejaculatory phases of semen collection.

Materials and methods
The kinematics of the hindquarters of two stallions used regularly for semen collection were studied at the mounting and ejaculation phases during semen collection on a phantom. Green spherical skin markers were placed on Th5, tuber coxae, proximal femur and tibia, and distal tibia and metatarsus. Hindquarter ROM and PF were measured at each phase with a home-video camera positioned perpendicular to the phantom. Differences in joint angle and movement measurements during the two phases were compared using commercially available software (SPSS; p<0.05).

Results
Horses showed significantly more extension in the tarsus (larger angle on flexor aspect) than in the hip and stifle joints, and the hind-limb was significantly more upright than the body (p<0.05). PF was significantly increased during ejaculation compared to mounting (p<0.05).

Conclusions
During ejaculation pelvic flexion is significantly increased compared to mounting. During both phases the tarsus shows more extension than the hip and stifle joints, while the hind-limb is significantly more upright than the body. It remains to be determined whether this affects the capacity for pelvic extension needed to clear fences during show-jumping.

References
MONITORING ACUTE EQUINE VISCERAL PAIN WITH THE EQUINE UTRECHT UNIVERSITY SCALE FOR COMPOSITE PAIN ASSESSMENT (EQUUS-COMPASS) AND THE EQUINE UTRECHT UNIVERSITY SCALE FOR FACIAL ASSESSMENT OF PAIN (EQUUS-FAP)

Recognition and treatment of equine pain has been studied extensively over the last decades. However, there is still need for improvement in the ability to objectively identify pain in horses with acute colic. This study assessed validity and clinical applicability of the EQUUS-COMPASS and the EQUUS-FAP in horses with acute colic.

Pain was assessed by means of EQUUS-COMPASS and the EQUUS-FAP scores from direct observation and by means of VAS scores, that were assessed from video clips in a prospective follow-up study using 50 adult horses (n = 25 horses with acute colic and n = 25 control horses). Patients were assessed at arrival, at 2-3 hours after arrival, and at the first and second morning after arrival. Control horses were assessed once in the same box.

Both the EQUUS-COMPASS and EQUUS-FAP scores showed high inter-observer reliability (ICC = 0.98 for EQUUS-COMPASS, ICC = 0.93 for EQUUS-FAP, P < 0.001), while a weak inter-observer reliability for the VAS scores was found (ICC = 0.63, P < 0.001).

Specificity and sensitivity for differentiating between pain-free horses and colic patients was good for both EQUUS-COMPASS (sensitivity 95.8%, specificity 84.0%) and EQUUS-FAP (sensitivity 87.5%, specificity 88.0%) and improved when weighting factors were applied to the individual parameters of the pain scores.

Because of good inter-observer reliability and high sensitivity and specificity, the use of EQUUS-COMPASS and EQUUS-FAP improves objectivity of pain scoring in colic patients and allows for good comparisons between different observers. This will be of benefit when different clinicians, caretakers and owners are involved in the care of a single patient.
SEDATION AND MECHANICAL HYPOALGESIA INDUCED BY FOUR DIFFERENT DOSAGES OF BUTORPHANOL IN XYLAZINE-PREMEDICATED DONKYS

Introduction
Combinations of α2-adrenoceptor and opioid agonists are commonly used in equines, but there is little scientific information on this topic in donkeys. This study compared the sedative and hypoalgesic effects of four dosages of butorphanol in xylazine-premedicated donkeys.

Material and methods
Six donkeys received the following intravenous (IV) treatments: saline and saline (S-S); xylazine (0.5 mg/kg) and saline (X-S); xylazine and butorphanol 10 μg/kg (X-B10); xylazine and butorphanol 20 μg/kg (X-B20); xylazine and butorphanol 30 μg/kg (X-B30); and xylazine and butorphanol 40 μg/kg (X-B40). Depth of sedation, using a simple descriptive scale (0–3) and measuring head height above ground (HHAG), and mechanical nociceptive thresholds (MNTs) of the left metacarpus were assessed at 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 70, 80, 90, 100, 110 and 120 minutes post-treatment. Areas under the curve (AUC) for 0-30, 30-60 and 60-120 min post-treatment were computed accordingly for sedation scores (SS-AUC), HHAG-AUC and MNTs (MNT-AUC). As appropriate, differences between treatments were analysed using the Friedman test followed by Dunn’s test and repeated measures one-way ANOVA followed by Tukey’s test.

Results
All treatments but S-S induced sedation. Butorphanol treatments induced significantly greater SS-AUC\(_{0-30}\) values than those for S-S (P<0.05), but S-S and X-S SS-AUC\(_{0-30}\) values were not significantly different (P>0.05). The HHAG-AUC-30 values for all treatments were smaller than corresponding values for S-S (P<0.001). For HHAG-AUC\(_{30-60}\) only X-B40 values were significantly smaller than those for S-S and X-S (P<0.05).

Compared to S-S, all treatments increased MNTs and yielded significantly higher MNT-AUC\(_{0-30}\) values (P<0.001). Treatment X-S yielded significantly lower MNT-AUC\(_{30-60}\) values than those for X-B30 and X-B40 (P<0.05). Only MNT-AUC\(_{30-60}\) values for X-B30 and X-B40 were significantly higher than those for S-S and X-S (P<0.05).

Conclusions
Xylazine induced sedation and mechanical hypoalgesia, which were enhanced by adding butorphanol at 40 μg/kg. This drug combination may be suitable for chemical restraint of donkeys undergoing clinical procedures.

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SEDATIVE AND MECHANICAL HYPOALGESIC EFFECTS INDUCED BY INTRAVENOUS AND SUBLINGUAL ADMINISTRATION OF DETOMIDINE IN DONKEYS

Introduction
In donkeys, there is little and no scientific information on detomidine injectable and oromucosal gel formulations. Here, their sedative and hypoalgesic effects were assessed.

Material and methods
Six donkeys received intravenous (IV) saline (S), detomidine 10 μg/kg (IV-D10), IV-D13.5, IV-D17, IV-D20, and acepromazine 50 μg/kg (ACE); and then sublingual (SL) molasses (M), detomidine 20 μg/kg (SL-D20), and SL-D40. Sedation scores (SS), head height above ground (HHAG) and mechanical nociceptive thresholds (MNT) were assessed. Areas under the curve (AUC) for 0–30, 30–60, 60–120 and 120–180 min post-treatment were computed accordingly for SS (SS-AUC), HHAG (HHAG-AUC) and MNT (MNT-AUC). Differences between treatments were analysed using Friedman test followed by Dunn’s test or repeated measures one-way ANOVA followed by Tukey’s test.

Results
All IV detomidine treatments, but IV-D10, significantly increased SS-AUC_{0-30} values as compared to S (P<0.05); IV-D17 SS-AUC_{0-30} values were significantly greater than those for ACE (P<0.05). All HHAG-AUC values were significantly smaller for detomidine than corresponding S (P<0.05; except for IV-D10 HHAG-AUC_{60-120}) and ACE values (P<0.05; except IV-D10 and IV-D20 HHAG-AUC_{60-120} and IV-D10 HHAG-AUC_{60-120}). Compared to S and ACE, all IV detomidine treatments significantly increased MNT-AUC_{0-30} and MNT-AUC_{30-60} values (P<0.05); IV-D10 MNT-AUC_{0-30} values were significantly smaller than corresponding values for IV-D17 and IV-D20 (P<0.05). IV-D20 MNT-AUC_{0-30} Values were significantly greater than corresponding values for S, IV-D10 and ACE (P<0.05).

Conclusions
Detomidine IV and SL induced dosage-dependent sedation and hypoalgesia. The oromucosal gel may be useful in donkeys.

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Both SL detomidine treatments induced significantly greater SS-AUC_{0-120} and smaller HHAG-AUC_{0-60}, HHAG-AUC_{60-120} and HHAG-AUC_{120-180} values than those for M (P<0.05); SL-D40 HHAG-AUC_{0-120} values were significantly smaller than those for SL-D20 (P<0.001). Compared to M, all MNT-AUC values were significantly higher for SL detomidine treatments (P<0.01).
THE EFFECT OF PARASITE BURDEN ON FAECALLY EXCRETED ALBUMIN

Introduction
Protein losing enteropathy is associated with parasitic disease in horses and faecal albumin has been used as a marker of intestinal protein loss in human medicine. The aim of this study was to establish if faecally excreted albumin, measured using a lateral flow immunoassay test kit (Succeed™) was related to the parasite burden of horses.

Materials and Methods
Faecal samples from 20 horses with no history of anthelmintic use over the preceding five months were tested using the test kit and also submitted for faecal worm egg count (FWEC). Blood samples were collected for tapeworm ELISA. FWECs ranged from 0epg-1000epg (mean 135epg, median 100epg), optical density of tapeworm ELISA ranged from 0.113 to 1.913 (mean 0.466, median 0.335). Moxidectin was administered to all horses one week after sample collection; praziquantel was administered to those with a tapeworm optical density of >0.2. The faecal occult blood test was repeated two weeks after anthelmintic administration.

Results and Conclusions
Of the 20 horses tested, five were positive for albumin both prior to and following the administration of the anthelmintic; eleven were positive prior to anthelmintic use and negative after, one was negative prior to anthelmintic use and positive after and three were negative on both occasions.

McNemar's tests were conducted and showed that faecal albumin was significantly more likely to be detected prior to administration of the anthelmintic than after (P = 0.004). Mann-Whitney tests failed to identify a significant difference in tapeworm ELISA optical density or FWEC between horses with different albumin status (P = 0.35 and P = 0.64)

This work indicates that parasite burden is associated with the likelihood of being positive for faecal albumin using the faecal occult blood detection kit (Succeed™), although greater numbers would be required to relate faecal albumin to specific parasite burden.

References
THE EFFECT OF A DIETARY SUPPLEMENT (SUCCEED™) ON GASTRIC ULCER SEVERITY

Introduction
The prevalence of squamous gastric ulceration in racing Thoroughbreds is 93.6%. The aim of this study is to assess the effect of a dietary supplement containing polar lipids and β-glucan (Succeed™) on the development and treatment of squamous gastric ulceration in racing Thoroughbreds.

Materials and Methods
Forty Thoroughbreds in race training or pre-race training with ≥grade 1 gastric ulceration on day zero of the trial were randomly assigned to one of two treatment groups, omeprazole (19 horses) or Succeed™ (21 horses). Both treatments were administered according to label dosage for the duration of the trial. Gastroscopy was repeated on day 30, 60 and 90 and the gastroscopy videos were reviewed by three boarded equine medicine clinicians who were blinded to treatment groups.

Results and Conclusions
At day zero the squamous gastric ulcer severity was similar between groups. At day 90, six horses receiving omeprazole had gastric ulcer scores which were one or more grades improved compared to day zero, thirteen horses had scores which were the same or worse. At day 90, eight horses receiving succeed had improved, thirteen had scores which were the same or worse.

Chi squared tests demonstrated no significant difference between the two treatments in the proportion of horse improving by two or more grades (P=0.53) or one or more grades (P=0.67). McNemars tests were applied to assess the effect of each treatment on gastric ulcer score. There was no significant improvement on gastric ulcer score with either omeprazole (P=0.38, P=1.0) or Succeed™ (P=0.50, P=0.68) when a clinically significant gastric ulcer score of ≥2 or ≥3 respectively was used to differentiate between affected and non-affected horses.

There is no statistically significant difference in the effect of omeprazole or Succeed™ dietary supplement for the treatment of squamous gastric ulceration in horses.

References:
EFFECTS OF ORALLY APPLIED GALACTO-OLIGOSACCHARIDES IN FOALS: A PILOT STUDY

Introduction
Newborn foals are highly susceptible to bacterial infections, due to both immature innate and adaptive immune responses, and the strong dependence on maternally acquired passive immunity via colostrum. In human infants and laboratory animals, dietary supplementation with galacto-oligosaccharides (GOS) has been shown to result in prebiotic and immunomodulating effects, with long-term beneficial consequences for gut health and immune competence. In a previous ex vivo study we demonstrated direct immunomodulatory properties of GOS in equine Peripheral Blood Mononuclear Cells (PBMCs)\(^1\). The current study was designed as a pilot study to investigate potential effects of orally applied GOS in foals in vivo.

Material and Methods
Healthy foals were treated during the first 4 weeks of life and subsequently followed up for another 10 weeks. Clinical and blood parameters for general health and immune status were investigated, including red and white blood cell parameters, serum protein levels, and specific immunoglobulin subtypes. At day 28, PBMCs were isolated from each foal and subjected to a standardised lipopolysaccharide (LPS) challenge.

Results
The applied dose regimen of GOS was well accepted by the foals and did not cause any detectable undesirable side effects. No significant effects of the GOS supplement were observed on gross clinical and blood parameters for health and immunity during the period of investigation. In PBMCs derived from GOS-treated foals, the LPS-induced relative mRNA expression levels of the pro-inflammatory cytokines interferon-γ and interleukin-6 were significantly lower compared with PBMCs of control foals.

Conclusions
Our findings suggest possible long-term beneficial effects of GOS supplementation in young foals with regard to gut health, bacterial infections and immune-mediated inflammatory disorders. Hence, dietary supplementation of foals with GOS warrants further investigation.

EQUINE INFLUENZA AND EQUINE HERPESVIRUS VACCINATION: EVALUATION OF IMMUNE RESPONSE AND SAFETY OF CONCURRENT ADMINISTRATION OF EQUIP® FT AND EQUIP® EHV 1,4

Aims
The concurrent administration of EHV1,4 and EIV vaccines is not currently recommended. This study aimed to evaluate safety and immunogenicity of concurrent administration of Equip®FT and Equip®EHV1,4 (treatment group T04) as compared to vaccination with Equip®FT (treatment group T02) or Equip®EHV1,4 (treatment group T03) alone.

Methods
Each treatment group included ten ponies vaccinated on study days 0 and 42. Immune responses to vaccine antigens were measured on day 56. Tetanus antibody titres were determined with the Toxin Binding Inhibition test (ToBI). Immunity to equine influenza virus (EIV) induced by vaccination was measured by Single Radial Haemolysis (SRH; antibody response) and IFN gamma assay (a marker of Cell-mediated immunity; CMI). Immune responses to Herpesvirus 1,4 were measured by Complement fixation (CF) and IFN gamma assay.

Results
Concurrent administration of EIV and EHV1,4 vaccines was well tolerated. Concurrent administration was proven to be efficacious against tetanus with similar serological immune response of treatment group T04 as compared to T02. Mean SRH results for ponies that received both vaccines were above 85 mm² for A/eq/Borlange/91 and A/eq/Kentucky/98 antigens, a threshold associated with clinical protection against closely related EIV strains. The highest levels of IFN gamma response were measured in group T02. Although concurrent vaccination seemed to have an effect on both EHV serology and EHV CMI, EHV results obtained during this study were not conclusive and may have been influenced by a natural EHV-4 infection occurring prior to study start.

Conclusion and practical relevance
Concurrent administration of Equip®FT and Equip®EHV1,4 was well tolerated and induced mean serum antibody levels consistent with clinical protection for tetanus and EIV. However, it was not possible to conclude about EHV immune response under the conditions of the study.
AN ASSESSMENT OF EQUINE LAMINITIC PATIENTS ADMITTED TO A UNIVERSITY AMBULATORY CLINIC: PREDISPOSING FIELD FACTORS AND UNDERLYING ENDOCRINOLOGICAL DISORDERS (2003 - 2013)

Introduction
Laminitis is a well-known and complex hoof disorder, but current knowledge more and more points towards it to be part of a systemic disease. The aim of the current study was to assess risk factors involved in the development of laminitis in equine patients that were presented to the first-opinion practice of a university.

Materials and methods
The case histories of all horses and ponies with laminitis treated by the Ambulatory Clinic of Utrecht University between 2003 and 2013 were analysed retrospectively (n=365). For every patient age, gender, breed and reported underlying systemic diseases were evaluated.

Results
Compared to the total population that was admitted, ponies, mares and patients older than 5 years were at a significantly higher risk of developing laminitis (P<0.05). In around 41% of the cases patients showed concomitant clinical signs of an underlying endocrinopathy. Equine Metabolic Syndrome (EMS) was most commonly differentially diagnosed in young horses and Pituitary Pars Intermedia Dysfunction (PPID) in older horses. However, a definitive diagnosis of these diseases using bloodtesting was only performed in 10% of the total cases.

Conclusions
With this study we gained a better understanding of specific predisposing factors for laminitis in a first-opinion equine practice. Underlying endocrinopathies play an important role and bloodtesting for EMS and PPID should be encouraged. Knowing the local risk factors for equine laminitis would help us to more adequately treat and prevent this disease in the field.

References
**ASSESSMENT OF MODERATE TO SEVERE AORTIC REGURGITATION BY 2D ULTRASOUND AND TISSUE DOPPLER IMAGING IN HORSES WITH A NORMAL LEFT VENTRICULAR SIZE**

**Aims**
Aortic regurgitation (AR) can lead to exercise-induced ventricular arrhythmia and left ventricular (LV) dilatation. The aim of this study was to improve ultrasonographic assessment of AR in horses with normal LV size.

**Methods**
Standard 2D and M-mode echocardiography was performed in ten healthy Warmblood horses (6±3 years, 556±40 kg) and ten with moderate to severe AR (17±6 years, 540±73 kg), all with a normal LV size. Aortic diameter was measured in systole, early (AoED) and late diastole (AoLD), and the diastolic decrease (AoED-AoLD) was calculated. From right parasternal Tissue Doppler short-axis images (TDI) at papillary muscle level, velocity (at peak systole, early diastole and atrial contraction), pre-ejection period (PEP), ejection time (ET) and peak strain were measured.

**Results**
In horses with AR, aortic diameter was significantly larger in systole (p=0.008), early diastole (p=0.003) and late diastole (p=0.013), with a bigger diastolic diameter decrease (p=0.009). PEP was significantly shorter in the AR group, when measured from M-Mode (p=0.000) and TDI images of the interventricular septum (p=0.005), but the difference was more pronounced in M-Mode images. The PEP/ET ratio was smaller in horses with AR (p=0.001). Peak systolic velocity of the interventricular septum was significantly higher in horses with AR (p=0.000), indicating increased septal motion. The LV free wall early diastolic velocity was lower in horses with AR (p=0.000). Peak strain could not be measured in the LV free wall and was not significantly different in the interventricular septum.

**Conclusions**
Aortic diastolic diameter decrease and shortening of PEP and PEP/ET are easily obtained parameters that proved to be useful to quantify AR in horses without LV dilatation. Further studies should be performed to determine the prognostic value of these parameters.
COMPARISON OF EQUINE PELVIC FLEXURE ENTEROTOMY CLOSURE TECHNIQUE WITH A TA-90 STAPLING DEVICE V. HAND-SEWN CLOSURE: AN EX-VIVO STUDY

Pelvic flexure enterotomies of the large colon are often performed in the equine during gastrointestinal surgery. Pelvic flexure enterotomy closure with the Thoracoabdominal stapling device (TA-90) has been described as a simple and time saving technique, with low incidence of complications.

Our objective was to compare enterotomy closure using the TA-90 stapler to the double layer hand-sewn closure, analysing time to complete the technique, luminal diameter and bursting pressure in ex vivo specimens.

The pelvic flexures of thirteen horses euthanatized for reasons unrelated to gastrointestinal disease were harvested. All pelvic flexures had one 6cm antimesenteric enterotomy performed; six were closed with the TA-90 stapler, the remaining seven were closed using a conventional double layer hand-sewn technique. The luminal diameter of the bowel at the enterotomy site was assessed via pre- and post-enterotomy contrast radiography. Bursting pressure of the closure was determined by continuous manometry throughout infusion with colored solution while the colon was submerged in warm water.

Time to complete stapled closure was significantly less than required for hand-sewn closure (p<0.0001). Post-enterotomy luminal diameters were significantly larger in stapled specimens when compared to hand-sewn (p=0.028). Percent change in luminal diameter between pre and post-enterotomy was significantly improved in stapled closures (p=0.034). There was no significant difference in bursting pressure between the two methods of closure (p=0.196).

The morbidity associated with equine gastrointestinal surgery has been attributed in part to the duration of the procedure. Stapled closure of enterotomy incisions offers significantly improved time to completion, does not compromise biomechanical strength, and maximizes post-enterotomy luminal diameter.