Mapping of prevalence, diagnostics and treatments of orthopedic injuries in Swedish trotting horses

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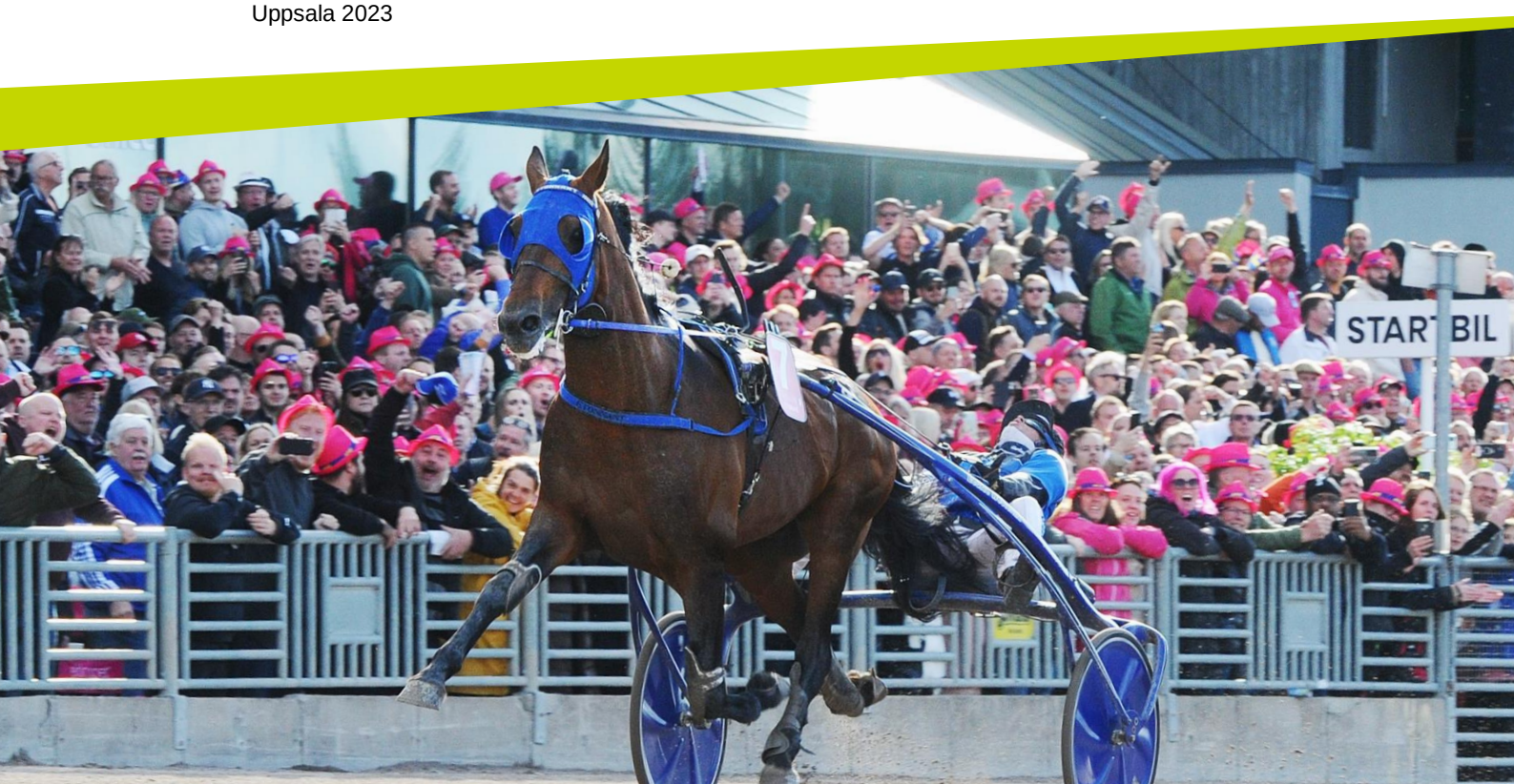

Mapping of prevalence, diagnostics and treatments of orthopedic injuries in Swedish trotting horses

Kartläggning av prevalens, diagnostik och behandling av ortopediska problem hos travhästar i Sverige.

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Abstract

Equine sport is the third largest sport in Sweden with an estimated number of 350,000 horses in the country. Trotting racing is the biggest branch in the Swedish equine industry, around 80,000 out of the horse population are trotting horses. Sweden is ranked to be among the top three leading countries in the world holding trotting races. The horses are trained intensely to run at high speed and perform at maximum capacity. The athletic performance can cause injuries and orthopedic problems are seen as the most prevalent type of injuries in racehorses. There is a wide range of pharmaceuticals available to treat orthopedic injuries as well as many diagnostic methods. The knowledge about the prevalence, diagnostics and treatments of orthopedic in the Swedish trotting horse population is not known.

It is rare that racehorses are insured to cover the cost of injuries caused by athletic use and therefore no insurance data is available on orthopedic diagnostics and treatments in trotters. This study aimed to investigate the prevalence, diagnostics and treatments of orthopedic injuries in trotting horses in Sweden. As far as the author is aware of, this is the first study that has attempted to execute a mapping of such. This study was done by two different surveys aimed to trotting horse trainers and racehorse veterinarians. In-depth interviews with professional trotting horse trainers were also performed and included in the results. Medical records from some trainers who participated in the in-depth interviews were used in the study. The surveys as well as the interviews contained questions about prevalence of diagnosed injuries, methods to diagnose and what pharmaceuticals that were used as treatment. The surveys were web-based and performed through Netigate (www.netigate.com), the data was also processed in Netigate.

The results showed that carpitis was the most prevalent diagnosis and that cortisone was the most commonly used drug for treatment of orthopedic problems. Some diagnoses seemed to popular and performed by specific veterinarians, as well as certain treatments. Results indicated that particular diagnostic methods and pharmaceuticals used deviated from treatment guidelines established by the Swedish Veterinary Association (SVF). In order to reach more precise results and comprehend the motivation of treatments and diagnostic methods, more veterinarians would need to participate in the survey and adding in-depth interviews of veterinarians could also provide additional insights.

Keywords: Harness racing, Standardbred, Joint injections, Diagnostic analgesia, Joint inflammation

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1. Introduction

Trotting is one of the largest sports in Sweden. Equestrian sports is ranked the third most popular sport in the country and trotting being the leading branch within equestrian with most horses participating. Out of the total horse population of 350,000 horses in Sweden there is about 80,000 trotting horses in the country (HNS *et al.* 2018). That means that almost every fourth horse in Sweden is a horse operating in the trotting industry (Svensk Travsport 2022a).

While it is known that orthopedic injuries are the most common cause of euthanasia in Swedish horses (Egenvall *et al*. 2009), there is a lack of data on what types of injuries and how these injuries are diagnosed and treated within the trotting horse population. In addition, racehorses are rarely covered by insurance for injuries related to athletic use which means that insurance data does not represent this group very well.

Racehorses are trained from a juvenile age and the aim of the preparation is to perform at top athletic level. For a racehorse to perform at maximum capacity they need to be healthy and pain free. It is of the utmost interest for the trainer to maintain their horses sound to achieve the best race results possible. Good racing performance is directly correlated to the possibility of monetary profits. To ensure healthy and race prepared horses many trainers use specific veterinarians that are specialized in trotting horses. The methods used to diagnose and treat the horses is perceived to be varying between different veterinarians according to medical records (Bertuglia *et al*. 2014).

The purpose of this study was to map the prevalence of orthopedic injuries and how these are diagnosed and treated within the trotting horse population in Sweden. The aim was to get an insight in how veterinarians make a diagnose and in what way different orthopedic problems were treated. This was done through two different types of survey and in-depth interviews that trotting horse trainers and veterinarians treating trotting horses participated in.

2. Literature overview

2.1 Trotting racing in Sweden

Trotting racing or as it is frequently called “harness racing” is a popular sport and equine discipline in the Scandinavian countries. It is a sport where the horse races at the specific gait of trot pulling a cart and it is sometimes carried out with a rider mounted, it is then called Monté (Bertuglia *et al*. 2014). Trotting races has been held in Sweden since the early 19th century and horse racing has a cultural past of being a major gambling sport (Svensk Travsport 2022a).

Sweden is ranked to be in the top three leading countries together with France and USA in trotting racing. The most valuable trotting race “Elitloppet” with a 11,350,000 SEK purse is held at Solvalla in Stockholm. It is currently 33 tracks where trotting races are held in Sweden, from down south in Malmö up to the north of Boden and races are held 364 days a year. Over 900 events connected to the racing and over 9,000 trotting races are held in the country annually (Svensk Travsport 2022a).

Gambling plays a large part of financing and keeping the trotting sport operating. In 2016 the largest betting vendor in Sweden “Aktiebolaget Trav och Galopp” (ATG) estimated that 13.3 billion SEK was placed on horse racing bets. This is 40% of the total turnover made in the entire equine industry in Sweden (Riksdagen u.å.) While galloping racing is also a part of horse tracing in Sweden the total of bets placed on the total horse racing in Sweden the trotting is estimated to trade 98% of the capital compared to the 2% that galloping trades. In 2018 over 900 million SEK in prize money and 150 million SEK in bonuses were the total purse of all races carried out in Sweden. How successful the horse performs in races correlates how much money the horse earns (ATG 2022a).

The industry is of importance for society out of a socioeconomic perspective. It is estimated that the entire equine industry employs around 30,000 full time jobs in Sweden each year. Many of the work opportunities are located rurally and creates an increase of jobs in a work market that is generally weaker compared to the urban

market. The industry accommodates all different social classes from working class to upper class investors (Riksdagen u.å.).

2.2 The trotting horse

Sweden holds a population of around 80,000 trotting horses with approximately 16,000 horses in current training. Horses of the breed Standardbred (SBT) and Coldblooded trotting horse are allowed to race in Swedish trotting races. The standardbred horse is the most used breed and over 90% of the races held yearly are for SBTs. The SBT horse is a lighter built horse that runs at higher speed than the Coldblooded trotter. The SBT is bred to hold high speed in the specific gait of trot. The horse has been bred for around 200 years and has its heritage in the English thoroughbred horse (USTA 2021). Sweden breeds around 3,200 trotting horses per year (Svensk Travsport 2022a).

2.2.1 Training the trotter

In order to train and compete under the Swedish trotting racing authority (Svensk Travsport) one must hold a trainer license. There are two types of trainers' licenses: A-licence (professional trainer) and B-licence (amateur trainer). There are around 400 A-licenced trainers and 3,300 B-licenced trainers in Sweden (Svensk Travsport 2022a). As an A-licenced trainer one is authorized to train an unlimited number of horses for an unlimited number of owners and representors. In order to receive an A-licence one must complete an education program and get approved from Svensk Travsport. To retain a B-licence the trainer must complete a shorter course in addition to get an approval from the ST association. A B-licensed trainer is allowed to train an unlimited number of horses if the trainer itself is the major representative for the horse and up to five horses that the trainer is not representative for (Svensk Travsport 2022b).

Trotting races in Sweden are held on a packed sand surface and raced on an oval track. The most common track distance is an oval of 1,000 m but there is a rare exception of tracks that measures shorter (800 m) and longer (1,600 m). Trotting horses are commonly trained on different surfaces other than the racing track. Alternative tracks used for faster work is: deep sand track, straight track, hill track and private oval tracks (Svensk Travsport 2022a).

2.2.2 Withdrawal times

In order to race on fair grounds and out of the animal welfare point of view, withdrawal times for medical treatments are established in each racing authority.

Swedish trotting racing holds one of the strictest rules in the world for their withdrawal conventions. The regulations govern how close to a race day certain type of treatments can be performed and what drugs that can be used. Depending on what pharmaceuticals used or treatment the horse undergoes, the withdrawal time varies. There are certain drugs that are prohibited to use in racehorses. The rules are reviewed frequently. Drug testing is performed on each race day. The testing is both randomly selected as well as targeted. Trotting horse trainers in Sweden are obligated to keep records of medical treatments for all horses they keep in training (Svensk Travsport 2022b).

2.3 Orthopedic problems in trotting horses

Issues with the locomotor apparatus has been shown to be the most common injury in racehorses (Vigre *et al*. 2002). Training for racing requires the horse to withstand high speed impact and athletic injuries can be a consequence of intense training. Orthopedic problem is a topic with a wide rage. It includes all injuries related to the locomotor apparatus which include the musculoskeletal system. Injuries to joints and tendons are often seen in all types of racehorses (Bertuglia *et al*. 2014).

2.3.1 Arthritis

Various studies have found that lameness due to joint disease is the most significant factor causing inability to race or decreased performance (Goodrich & Nixon 2006). Several lameness issues are diagnosed and treated as joint inflammations in performance horses. Traumatic arthritis occurs after an injury. In racehorses this is common because of the repetitive strain on joints from athletic use. Traumatic arthritis involves inflammation of the synovial membrane and the surrounding joint capsule. Eventually it can lead to a loss of cartilage in the joint and instigate osteoarthritis. The early symptoms of inflammation to the joint can be pain and an increase of synovial fluid surrounding the affected joint. Further the joint can be affected with reduced range of motion and a thickening of the joint capsule (McIlwraith 1996). Depending on the severity of the inflammation it can disturb the function and movement of the joint. Lameness or disturbance in the pattern of movement can be a symptom of the inflammation (Brokken 2019).

2.3.2 Medical treatment of arthritis

The equine medicine uses a variety of drugs to treat joint inflammation and veterinarians have access to a wide range of preparations for treating joint inflammation (Goodrich & Nixon 2006).

Nonsteroidal anti-inflammatory drugs (NSAIDs)

NSAID drugs have been used for over 100 years. It is a type of drug that is frequently used to treat orthopedic problems due to its properties that are analgesic, antipyretic, and anti-inflammatory. There are several types of NSAID drugs on the market. NSAID drugs are generally administered IV or orally in equine medicine (Zanotto & Frisbie 2021). The pharmacodynamics of NSAID drugs is that they inhibit the enzyme cyclooxygenase (COX), whose function is to convert arachidonic acid into prostaglandins that both contribute to inflammation and pain signalling. NSAIDs have their main action on the COX enzymes, COX-1 and COX-2. Different preparation of NSAIDs have varying selectivity for these enzymes. Roughly NSAID drugs can be divided into nonselective COX-inhibitors and COX-2 selective inhibitors. The side effects for the two varies (Jacobs *et al*. 2022). Example of NSAIDs used in equine medicine is flunixin megalumin, phenylbutazone, ketoprofen, carprofen, meloxicam, and firocoxib (Jacobs *et al*. 2022). Most NSAID drugs has a withholding time of 14 days to racing for trotting races in Sweden (Svensk Travsport 2022b).

Corticosteroids

There are many types of preparations of corticosteroids available for use in veterinary medicine. Intra articular injections of corticosteroids are frequently used to treat arthritis in horses. Corticosteroids are a high potent anti-inflammatory agent that gives a strong supress of the immune response and some literature suggests that it is currently the most potent treatment for inflammation available (Zanotto & Frisbie 2021). Corticosteroids depresses several inflammatory responses and has anti-inflammatory, antipyretic and analgesic properties. When given locally most of the anti-anabolic effects are regulated locally. Local injections are frequently used in joints and bursal structures in equine medicine (Harkins *et al*. 1993). In the past, injections to tendons and ligaments were described as adequate, recent studies have shown that the usage of cortisone injections in tendons and ligaments can cause damage to its structural pattern as well as predispose for rupture of the tendon/ligament (Lu *et al*. 2016). The pharmacodynamics connected to corticosteroids has been proved that glucocorticoids are primary metabolized through the liver. Effects of the drug can be capillary dilatation, margination, migration, and accumulation of inflammatory cells. Particularly corticosteroids inhibit prostaglandin production by inhibiting phospholipase A2 and cyclooxygenase. The consequence of inhibiting arachidonic acid metabolism is a rapid and pronounced

reduction in pain (Harkins *et al*. 1993). Common preparations used for intra articular injections in equine medicine is betamethasone, triamcinolone and dexamethasone (Caron & Genovese 2003). Most preparations hold a withdrawal time of 28 days to racing although some preparations are available with a shorter half time that holds a withdrawal time of 14 days, for example dexamethasone (Svensk Travsport 2022b).

Plated rich plasma

Plated rich plasma (PRP) also known as Autologous Conditioned Plasma (ACP) is a concentrate of platelet-rich plasma protein. It is derived from whole blood, centrifuged to remove red blood cells. The concentrated plasma remaining is used as a preparation to treat orthopedic problems. PRP has become more popular in veterinary- as well as human medicine during the last two decades, it is used for intramuscular, intra-tendinous and intra articular therapy (Wu *et al*. 2016). PRP is used because of its therapeutic potential of a high concentration of platelets that is seen to contain essential growth factors to provide a regenerative stimulus that promotes restoration in tissues with less blood supply and lower healing potential (Camargo Garbin *et al*. 2021). The withdrawal time for PRP in Sweden is 14 days (Svensk Travsport 2022b).

Dimethyl sulfoxide

Dimethyl sulfoxide (DMSO) is an organosulfur compound with the chemical formula (CH3)2SO. DMSO is commercially used as a solvent. DMSO is used both in human and veterinarian medicine. It is most known for its properties of working analgesic, anti-inflammatory and antioxidative (Hillidge 1985). DMSO is approved for topical and intravenous use for equines in many countries, for example in USA (Kentucky Equine Research 2018). In the guidelines written by the Swedish Veterinarian Association (SVF) DMSO is not approved for intra articular use. DMSO holds a withdrawal time of 14 days in Sweden (Svensk Travsport 2022b).

2.4 Orthopedic diagnostics

Orthopedic injuries affect the locomotor apparatus in the horse. Orthopedic injuries can present lameness as a symptom, an injury can also be present without showing any lameness. There are orthopedic injuries that can be subclinical, for example a bilateral joint inflammation, or a low-grade inflammation. These types of pathology does not necessary present lameness as a symptom (Ross 2003a). The veterinarian need to assess the movement pattern of the horse, diagnostic imaging may also be required, in examination of orthopedic injuries (Armstrong *et al*. 2009).

2.4.1 Lameness examination

Palpation
Palpation of the musculoskeletal system is a customary technique performed by the veterinarian to detect any abnormality from the sound horse. All four limbs should be assessed when bearing weight and elevated from the ground. The aim of the palpation is to detect any sign of injury on extremities. Ross, 2003, claims that full palpation can allow the veterinarian to make predictions about cause of lameness in order to make a correct diagnosis (Ross 2003b).

Subjective lameness assessment
Subjective evaluation from observing a horse in motion is a standard of diagnostic methods for the equine veterinarian. It is traditionally performed with a horse led by hand in a straight line in the gait of walk and trot. This method is used to observe the movement of the horse and detect any lameness or deviation from the movement pattern. It can also be performed by lunging a horse on a circle or observing the horse on a treadmill, these methods also facilitate the ability to evaluate the horse in canter or gallop. Subjective movement analysis can also be performed by evaluating the horse being ridden or driven in a sulky (Keegan *et al*. 2010).

Objective lameness assessment
Sensor based motion analysis has become a more used method in order to make a correct diagnosis for orthopedic problems in equine medicine within the last decade. Objective methods of detecting and quantifying lameness are a tool to prevent involuntary evaluation bias from the clinician. Sensor based methods are objective since it collects data and measures the movement symmetry in the horse. It is based on a method that quantifies lameness on an uninterrupted scale in motion. The analysis aims to diagnose and recognize the lameness based on the sensory data that is collected. There are several types of objective lameness assessment systems used in the veterinary industry (Keegan *et al*. 2004).

Flexion test
In order to diagnose where the pathology is located it is common that the veterinarian use manipulation to emphasize lameness. Flexion tests are frequently used in equine medicine and is based on that the limb of the horse is flexed and held up in a position for a certain time, the manipulation can elevate the suspected lameness when the horse starts moving. It can be difficult to detect lameness if more than one limb is affected, if it is a low-grade lameness or if the cause is bilateral. This can be a cause of gait abnormality without lameness present. Flexion tests are executed to exacerbate the baseline lameness and the purpose is to localize the source of pain within a limb. It is not an utterly accurate method for diagnosis, it

has been proven that some results of provocation is false positive and also false negative (Ross 2003b).

Diagnostic Analgesia
A tool used to determinate where the cause of lameness is located is local diagnostic analgesia. The method is based on that a joint or nerve is temporarily blocked via local anaesthetic drugs. Two common drugs used for diagnostic analgesia is mepivacaine and lidocaine. According to Bassage & Ross (2003) it takes anatomical and practical knowledge in order to perform an analgesia of the locomotor apparatus. It is either performed by blocking the sensory response on a specific joint/joints or the nerves surrounding an area of the limb. The aim is to block the sensory pain response from the suspected area of injury. The diagnostic analgesia can thereafter be evaluated through a subjective or objective movement evaluation (Bassage & Ross 2003). According to the Swedish treatment guidelines, diagnostic analgesia is always recommended before any joint treatments with exceptions to certain circumstances (Hästsektionen SVF 2021).

2.4.2 Diagnostic imaging

Diagnostic imaging contains various techniques of observing the body internally. It is used to diagnose or confirm the causes of a disease or injury. There are various technics of imaging used in veterinary medicine. The most used methods are plain X-ray and ultrasound, although some practises have an availability of MRI and CT (Armstrong *et al*. 2009).

3. Purpose of the study

Literature suggests that trotting horses frequently suffer from orthopedic injuries and that there are many ways to diagnose and treat such (Bertuglia *et al*. 2014). However, due to the shortage of insurance data and lack of previous studies, little is known about prevalence and treatments of these injuries.

The purpose of the study was to map the prevalence and diagnoses of orthopedic injuries in the trotting horse population in Sweden. The aim was to see what type of injuries that are perceived as the most common and what methods and drugs that were used to diagnose and treat them. How the diagnose was made by the veterinarian is of relevance to conclude whether it is likely that the correct diagnose has been made. It was also of value to establish an understanding on how the trainers viewed their horses' orthopedic problems and how they evaluated the veterinary treatments. This in order to estimate if trainers thought correct treatments and diagnostics were applied. It was relevant to investigate racehorse treating veterinarians views on the prevalence of injuries, treatments and possibilities to make a correct diagnose in the process of the mapping, that was the purpose of the study.

The main purpose was to obtain research that could lead to better possibilities for diagnostics and development of veterinary care for orthopedic injuries in trotting horses.

4. Material and methods

4.1 Survey

Two different types of online survey studies were designed. One survey was aimed for trotting horse trainers and the other survey was aimed for trotting horse treating veterinarians.

Both surveys were made in Netigate (www.netigate.com) and were completely anonymous. It was possible to choose more than one answer to most questions in both of the surveys. In order for a respondent to be included among the answers, a sufficient number of questions needed to be answered in the survey. This was calculated by the survey tool (Netigate).

4.1.1 Survey to trainers

This survey was made by an online questionnaire. The survey was directed to trotting horse trainers in Sweden. The online questionnaire contained 48 questions and was estimated to take up to 10 minutes to complete. The questions were divided into three pages containing questions focusing on different areas. Page 1 contained questions about demographic information and information about the nature of the trainers operation. Page 2 questioned the relationship between the trainer and the veterinarian as well as questions about the prevalence of injuries and diagnostic methods used. Page 3 questioned what type of pharmaceuticals that were used and the effects of the treatments. Most questions contained multiple choice answers with the ability to write a free answer if none of the other options suited. Some questions were scaled, the options were then between 0-100%. If the respondent filled in that they did not hold a trainers' licence, the survey was automatically terminated.

The survey was pilot tested with two trotting trainers. None of these answers were included in the result but were used as a review to evaluate if the questions were reasonable and understandable. The survey was also approved and reviewed by the

chairman of the Swedish Trotting Association (Svensk Travsport). The survey was adjusted after the reviews of the pilot study before it was launched.

The survey was made available through Svensk Travsports website (www.travsport.se), and Svensk Travsports Facebook page. It was made available through a weblink and a QR-code. The survey was targeted to trotting horse trainers and the racing authority encouraged trainers to participate. The survey was available between 29/09/2022 to 31/09/2022. There are around 3,000 licence holding trotting horse trainers in Sweden (Svensk Travsport 2022a).

4.1.2 Survey study for veterinarians

This survey contained similar questions as the trainers-survey but from a veterinarian perspective. The aim of the survey was to target trotting horse treating veterinarians to see how and what they diagnose, treat, and what their personal view of veterinary care for trotting horses in Sweden were. It was a total of 50 questions in the survey. Questions focused on prevalence and diagnostics of orthopedic injuries and were divided in three sections; page 1 contained questions about demographics and general information about the nature of the veterinarians, page 2 focused on questions about diagnostic methods and injury prevalence, page 3 questioned what type of pharmaceuticals that were used for treatment and how the effects of the treatments were experienced. The questions were designed under supervision of two veterinarians.

The survey was made available through Hästsektionen; a branch of the Swedish veterinary association for veterinarians practising equine medicine in Sweden. It was emailed out to the clinicians that were members of Hästsektionen. In addition to this, the survey was shared by targeted emails to private practices and larger equine clinics that are known to be working with trotting horses. It was not possible to estimate how many veterinarians that were contacted as it was unknown how many veterinarians working at the different workplaces that were connected with trotting horses. The survey was made available through a weblink and a QR-code. It was available to respond to between 30/09/2022 2022 to 31/10/2022. The survey was automatically terminated if the respondent filled in that they were not a veterinarian or that they did not treat trotting horses.

4.2 In depth interviews

In-depth interviews were made with A-licensed trotting horse trainers in different locations across the country. Most interviews were made on site of the trainers' location for practice. All interviews were guaranteed to be completely anonymous in the study. The choice to visit the stables to do interviews was made to get a broader understanding of how the training operation worked and to have a more transparent conversation. A-licensed trainers with a larger number of horses in training were selected since it was hypothesised that it would be more difficult to get this group to be representative in the survey study. The population were also selected due to the larger number of data available on their horses. The interviews were recorded and summarised into a written document before analysed.

The trainers that were interviewed were questioned if they wanted to contribute with individual medical journals for their horses to contribute to the research. It was optional to share medical records in favour for the study. The individual medical journals were gathered in order to compare the trainers' subjective opinion on treatments and injuries to documented information on the subject.

4.3 Analysis

The two survey studies were analysed through Netigate that collected and processed the data from the questionnaires. Descriptive tables and graphic content used in results were created in Netigate and evaluated by visual assessment.

The in-depth interviews were qualitatively analysed through recordings and summaries from the interviews by identification of information and reoccurring themes. The medical journals of the individual horses were analysed and compared to the results of the interviews and the survey studies.

5. Result

5.1 Survey study – trainers

The survey targeting trotting horse trainers received a total of 227 responses. The survey tool assessed that 197 responses could be used in the analysis as these provided answers to a sufficient number of questions in the survey according to the survey tool Netigate, this was calculated by the survey tool. For those who answered that they did not obtain a trotting trainer license, the survey was automatically terminated.

5.1.1 Page 1. The trotting trainer

This page contained questions focusing on identity and the nature of the responding trainer. Out of the respondents, 34% stated that they were men and 66% that they were women. The age distribution of the respondents were; 14% <25 years of age, 22% 26-35 years, 20% between 36-45 years, 39% between 45-65 years and 13% >65 years. The respondents represented a large geographical spread across Sweden, see diagram of geographics (figure 1). Two respondents stated that they did not live in Sweden.

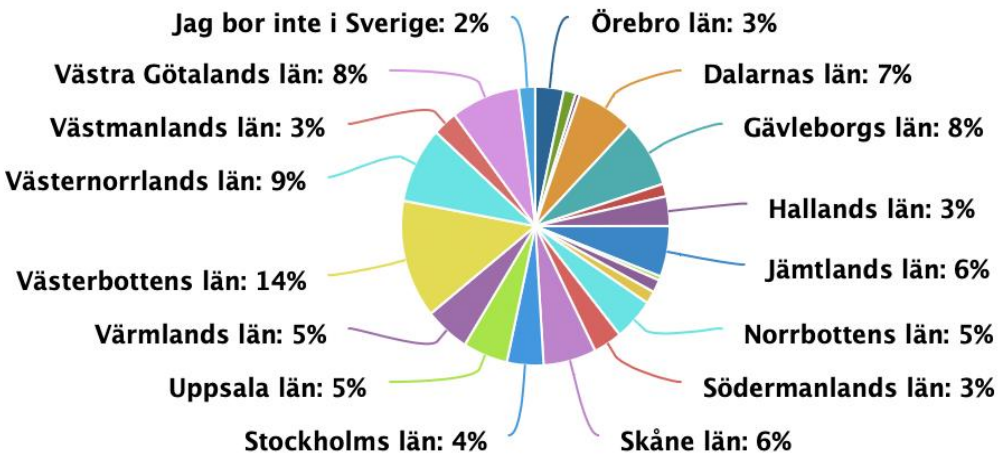
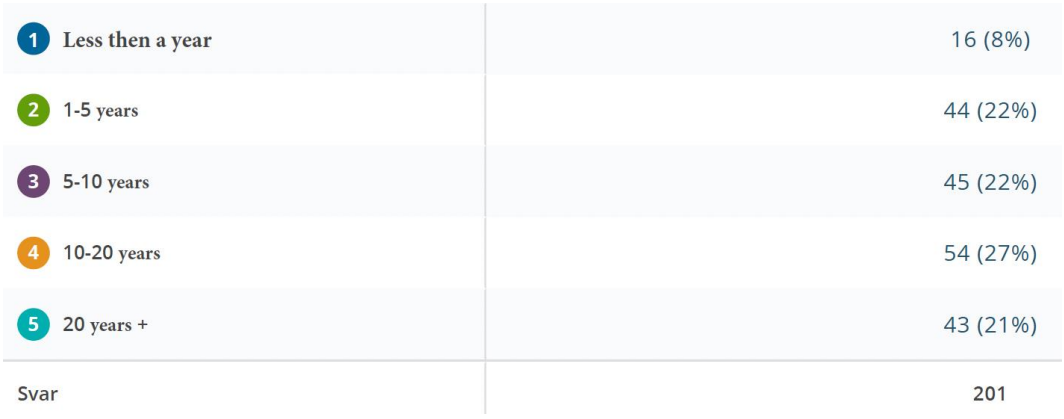


Figure 1. Geographic spread – trainers.

To the question about type of license held, 11% stated that they held an A-license, 71% had a B-license, 2% held a license outside of Sweden. Sixteen percent responded that they did not hold a trainers license, for these participators the survey was automatically terminated and not included in the 197 responses that were seen to answer a sufficient number of questions according to the survey program. The spread for how long the trainers license had been obtained had an even coverage, it is presented in the figure below (Figure 2).



1 Less then a year	16 (8%)
2 1-5 years	44 (22%)
3 5-10 years	45 (22%)
4 10-20 years	54 (27%)
5 20 years +	43 (21%)
Svar	201

Figure 2. Years of obtaining a trainers license, n value of 201 responses.

The majority of the respondents (83%) had 1-5 horses in training. Of the remaining 2% had 5-10 horses, 8% had 10-20 horses, 6% had 20-50 horses, 2% had 50-100 horses. No respondent had more than 100 horses in training. The types of surfaces used for training, by order of frequency, were; straight tracks (49%), hill training (38%), deep sand track (23%), oval track (16%). Twenty-two percent (75 responses) stated that they used a surface type not presented in the question. There was an option of writing a free answer to this question, 58 free answers were submitted, 24 of those said that training was performed on country roads/forest trails, 11 stated that training was performed in a riding arena, the other responses varied and none of those responses were prevailing, and no reoccurring pattern could be seen in those. It was possible to choose more than one option to this question, hence the results of over 100%.

5.1.2 Page 2. The trainer and the veterinarian

This page contained questions about how the trainer works with the veterinarian. The majority of the trainers (90%) reported using a specific veterinarian. Of the remaining 9% did not use a specific veterinarian and 1% selected other. Slightly more than half (61%) reported that they used different veterinarians for different medical problems, example; one veterinarian for respiratory problems and another for orthopedic problems. How often a veterinarian was consulted to the training operation resulted in that 5% said that they consulted a veterinarian once a week,

7% once a month, 7% 2-3 times a month, 22% 1-4 times a year, 58% stated that they only consulted a clinician when needed and 1% said they did not use a veterinarian. It was common to use alternative treatments, the diagram below presents what type of alternative treatments the trainers stated using to treat their horses excluding veterinary care (Figure 3).

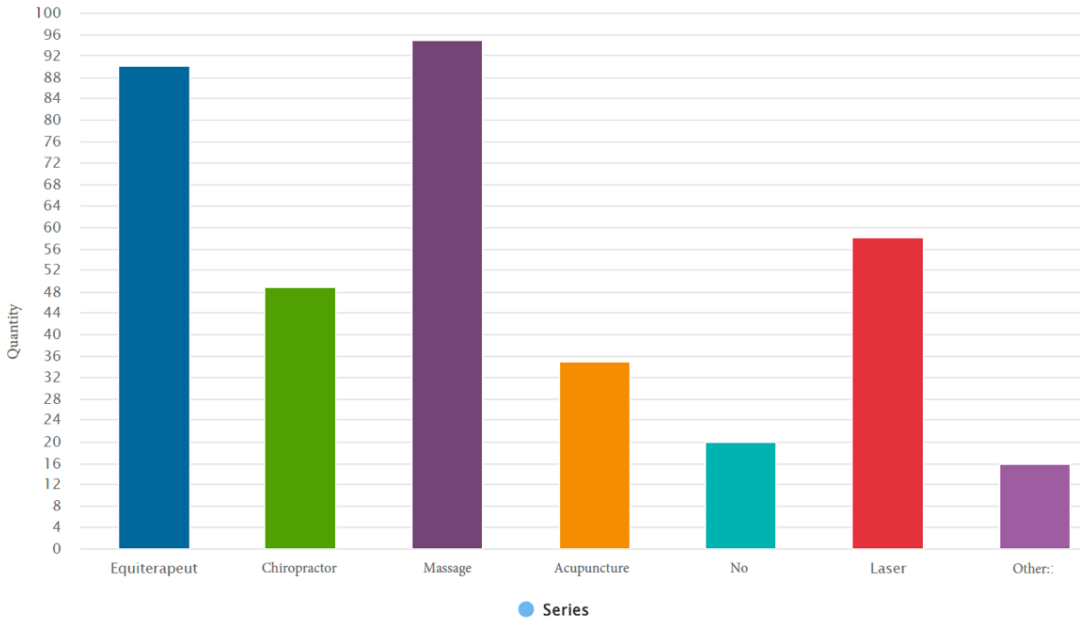


Figure 3. Alternative treatments used by trotting trainers, n=156 responses, it was possible to choose more than one alternative to this question.

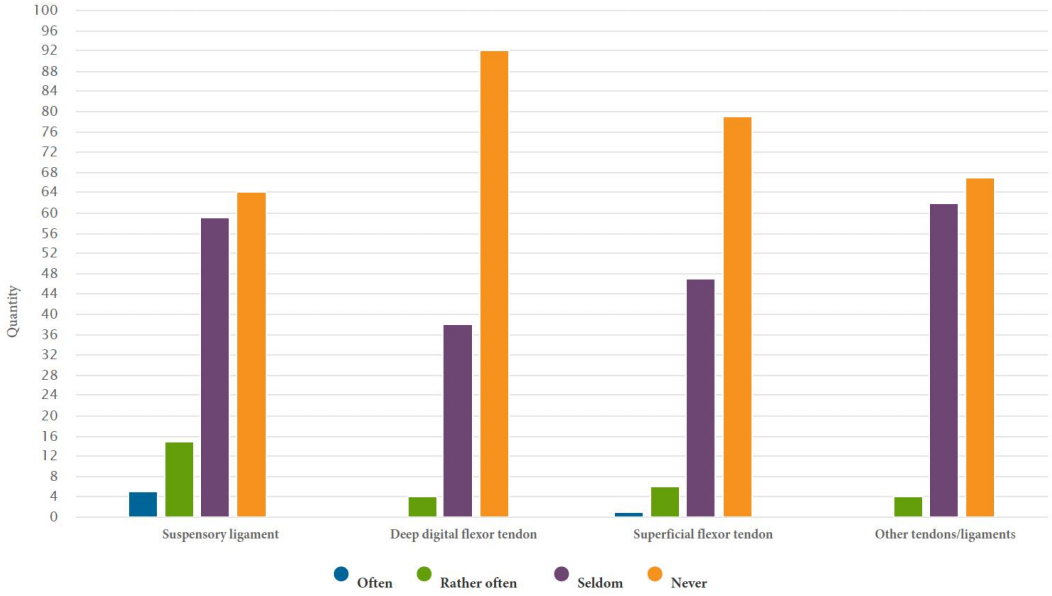
When asked what the most common health problem for consulting a veterinarian was, 82% responded orthopedical problems, 18% airway problems, 15% lacerations and 13 % chose other problems. It was possible to choose more than one option on this question. Joint inflammation 82% was seen as the most common diagnosis when evaluating lameness in the horse, muscular problems 13% was the second and tendon/ligament injuries 10% the third most preferred option when it came to lameness diagnosis. This question was also available to choose more than one answer to. The carpal joint resulted in being the most common treated joint, the frequency of which different joints were treated are presented below (Figure 4).

	NEVER TREATED	SELDOM	OFTEN	ALWAYS
Carpus	22 (15%)	**72 (51%)**	43 (30%)	5 (4%)
Fetlock front	35 (27%)	**73 (56%)**	22 (17%)	1 (1%)
Fetlock hind	56 (43%)	**65 (50%)**	8 (6%)	1 (1%)
Tarsus	**65 (50%)**	53 (40%)	12 (9%)	1 (1%)
Coffin joint front	54 (41%)	**65 (49%)**	12 (9%)	1 (1%)
Coffin joint hind	**99 (76%)**	28 (21%)	4 (3%)	0 (0%)
Sl-joint	**64 (48%)**	49 (37%)	18 (14%)	1 (1%)
Humeral	**98 (75%)**	27 (21%)	5 (4%)	0 (0%)
Hip	**99 (76%)**	27 (21%)	4 (3%)	0 (0%)
Stifle	25 (19%)	**65 (50%)**	39 (30%)	2 (2%)

Carpus	**142**
Fetlock front	**131**
Fetlcok hind	**130**
Tarsal joint	**131**
Coffin joint front	**132**
Coffin joint hind	**131**
Sl-joint	**132**
Humeral joint	**130**
Hip joint	**130**
Stifle joint	**131**

Figure 4. Frequency in joint treatments – trainers. The top table shows the outcome of joint treatments, the first number represents how many that chose the option, and the parentheses shows what percentage out of the total n-value that was. The bottom figure presents how many responses that were submitted for each joint.

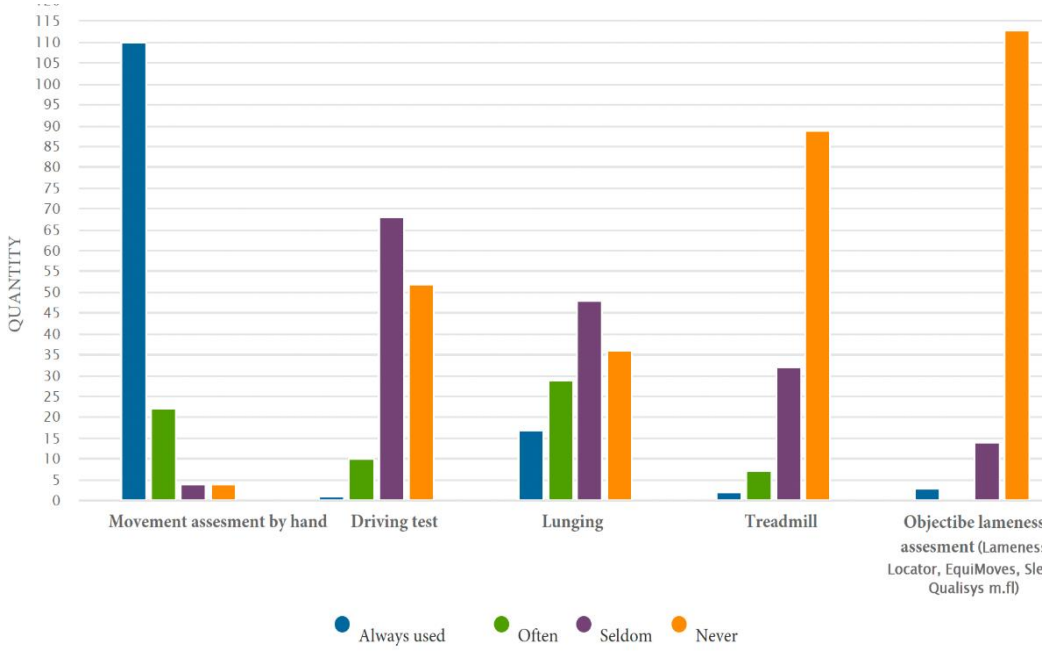
Injuries to the suspensory ligament were the most common diagnosed injuries to tendon/ligaments. The prevalence of diagnosed injuries in tendon/ligaments are presented in the diagram below (Figure 5).



	Often	Rather often	Seldom	Never
Suspensory Ligament	5 (3%)	15 (10%)	59 (41%)	**64 (45%)**
Deep digital flexor tendon	0 (0%)	4 (3%)	38 (28%)	**92 (69%)**
Superficial flexor tendon	1 (1%)	6 (5%)	47 (35%)	**79 (59%)**
Other tendons/ ligaments	0 (0%)	4 (3%)	62 (47%)	**67 (50%)**

Figure 5. Prevalence tendon/ligament injuries, it was possible to choose more than one option in the question. The graph is based on the numbers from the table below, the number in front of the percentual parathesis represents the respondent frequency for each option.

When asked if the diagnose the horse got varied depending on the veterinarian performing the examination, 54% said yes, 15% no, 24% sometimes and 7% answered that they did not know. Movement assessment by hand were the most used method of movement assessment, the usage of diagnostic methods by the veterinarian when examinating lameness, as perceived by the trainers, is presented in the diagram below (Figure 6).



	Always used	Often	Seldom	Never
Movement assesment by hand	**110 (79%)**	22 (16%)	4 (3%)	4 (3%)
Driving test	1 (1%)	10 (8%)	**68 (52%)**	52 (40%)
Lunging	17 (13%)	29 (22%)	**48 (37%)**	36 (28%)
Treadmill	2 (2%)	7 (5%)	32 (25%)	**89 (68%)**
Objective lameness assesment	3 (2%)	0 (0%)	14 (11%)	**113 (87%)**

Figure 6. Diagnostic methods lameness assessment trotting trainers, the content in the table is illustrated in the diagram, the number in front of the percentual parenthesis is the number of respondents to each option.

The question "*How often does your veterinarian use diagnostic analgesia to localize where the lameness is coming from*?" resulted in 15% saying it was always used, 41% often used, 39% seldom used and 4% never used. The outcome of how often and what type of diagnostic imaging that was used is presented in the table below (Figure 7).

	Never used	Often	Seldom	Always
X-ray	11 (8%)	48 (35%)	**77 (56%)**	2 (1%)
Ultrasound	10 (7%)	54 (39%)	**70 (51%)**	4 (3%)
MR	**93 (67%)**	2 (1%)	35 (25%)	8 (6%)
CT	**106 (79%)**	4 (3%)	22 (16%)	3 (2%)

Figure 7. Diagnostic imaging used – trainer survey. The number in front of the parenthesis is the number of respondents to each option

5.1.3 Page 3. Lameness treatments

Page 3 of the survey focused on what treatments the veterinarians administered on the trotting horses when treating lameness. Cortisone appeared to be the most used pharmaceutical for joint injection, the spread on what pharmaceuticals that were used to treat joint inflammation had the outcome as presented in the table below (Figure 8).

	Always used	Often	Sometimes	Seldom	Never
Cortisone 28 days withdrawal	13 (8%)	**50 (32%)**	44 (28%)	24 (15%)	24 (15%)
Cortisone 14 days withdrawal	5 (3%)	32 (22%)	**53 (36%)**	38 (26%)	20 (14%)
Systemic NSAID	1 (1%)	21 (14%)	39 (27%)	**54 (37%)**	32 (22%)
Hyaluronic acid	2 (1%)	19 (13%)	24 (16%)	36 (24%)	**66 (45%)**
Platelet-rich plasma (PRP) / ACP	2 (1%)	11 (8%)	19 (13%)	28 (19%)	**86 (59%)**
IRAP	0 (0%)	7 (5%)	19 (13%)	37 (26%)	**82 (57%)**
DMSO (DiMetylSulfOxid)	3 (2%)	17 (12%)	32 (22%)	30 (21%)	**63 (43%)**
Stemcells	0 (0%)	0 (0%)	2 (1%)	23 (16%)	**120 (83%)**
PSGAG (ex Adequan)	0 (0%)	0 (0%)	4 (3%)	24 (17%)	**117 (81%)**

Figure 8. Pharmaceuticals used to treat joint inflammation, the number in front of the parenthesis is the number of respondents to each option.

When asked what medicine that was most used to treat joint inflammation cortisone was prevailing, the complete result was as presented in the table below (Figure 9).

1 Cortisone 28 days withdrawal	81 (54%)
2 Cortisone 14 days withdrawal	62 (41%)
3 Hyaluronic acid	30 (20%)
4 Systemic NSAID	19 (13%)
5 Platelet-rich plasma (PRP)	17 (11%)
6 IRAP	15 (10%)
7 DMSO (DiMetylSulfOxid)	31 (21%)
8 Stemcells	2 (1%)
9 PSGAG	1 (1%)
10 Other:	10 (7%)
Svar	151

Figure 9. Most used pharmaceutical to treat joint inflammation – trainer survey. N-value 151, the number in front of the percentual parenthesis is the number of respondents to each option.

1 0-10 %	44 (32%)
2 10-33 %	30 (22%)
3 34-50 %	18 (13%)
4 50-75 %	16 (12%)
5 75% +	17 (13%)
I do not know	11 (8%)

Figure 10. The question quired to estimate a percentage span of horses treated more than one time for same problem, the number in front of the percentual parenthesis is the number of respondents to each option.

The result enquiring what treatments that were used to treat tendon/ligament injuries resulted in 76% responded conservative treatment (rest), 26% laser, 19% shockwave, 18% other treatment and 5% injection with pharmaceuticals. It was possible to choose more than one answer option to the question. Cortisone and stem cells where the two pharmaceuticals that respondents stated that they used as injected medications for tendon/ligament injuries.

The trainers got to estimate how many percentages of their two-year-old horses that were treated for orthopedic problems during 2021. The average value to the question resulted in 8.50% of the two-year-olds. The same question was asked about the three-year-old horses and the average value was 20.1%. The question was also asked about the horse population of 4 years and older and the average value resulted in 40.1%. The survey questioned to estimate how many percentages of the horses in training that ended their careers due to orthopedic injuries and the average value was 24.0%. In a comparable question the respondents were to estimate how many percentages of the horses that end their careers due to lack of performance even though they appeared free from injuries. The average value was 40.4 %.

A question in the survey asked about how many of the horses treated for lameness that the trainers experienced an improvement in after treatment. The result was that 63% thought that a large part (80-100%) of the horses had improved, 21% said that a little more than half (60-80%) had improved, 13% that half of the horses (50%) improved, 3% that a bit less than half (30-40%) had improved and 1 % said that none or very few (0-30%) improved after treatment.

When quired if the treating veterinarian usually advised on a rehabilitation plan after lameness treatment, 65% said yes, 15% no and 20% sometimes.

The question "*Do you feel that there is a lack of knowledge of the trotting horse orthopedic problems among veterinarians who do not usually work with racehorses*?" resulted in 52% saying yes, 15% no, 25% sometimes and 8% other.

The last question of the survey was "*Do you have suggestions on how diagnostics of orthopedic problems in trotting horses could be improved*?" and it was only possible to write a free answer. There was a total of 26 free written answers submitted. Better communication between the veterinarian and the trainer, more thorough diagnostics and possibilities for veterinarians to watch race replays were the three most predominant responses. It was also brought up that trainers wished that insurances would cover more of the costs from injuries related to athletic use.

5.2 Survey study – veterinarians

The survey targeting trotting horse treating veterinarians received a total of 49 responses. The survey tool assessed that 43 responses could be used in the analysis as these provided answers to a sufficient number of questions to be included in the result, this according to the survey tool (Netigate). For those who answered that they were not veterinarians or that they did not treat/ had treated trotting horses, the survey was automatically terminated. These respondents were not included in the 43 responses included in the results.

5.2.1 Page 1: The racehorse veterinarian

The first page of the survey focused on questions about the veterinarian. Out of the respondents, 29% stated that they were men and 71% that they were women. The age distribution of the respondents were; 21% 25-35 years, 23% 36-45 years, 19% between 46-55 years and 38% where over the age of 55 years. The respondents represented a large spread across Sweden, see diagram (Figure 11).

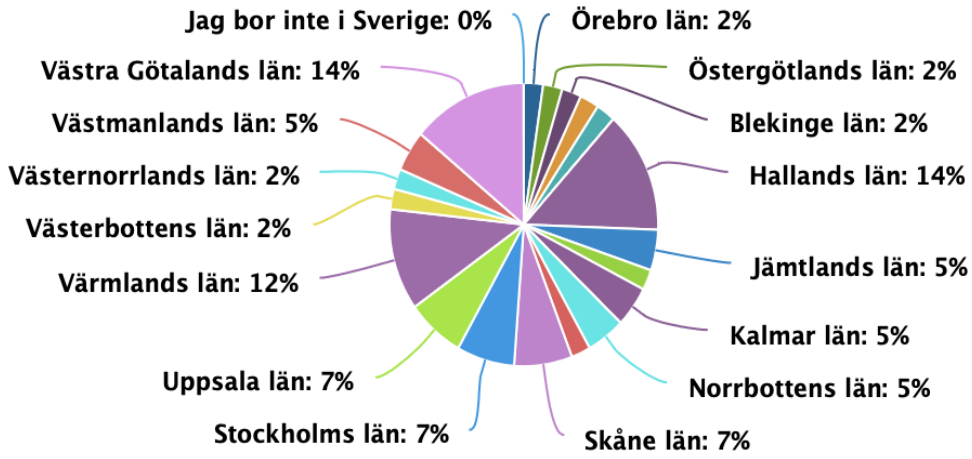


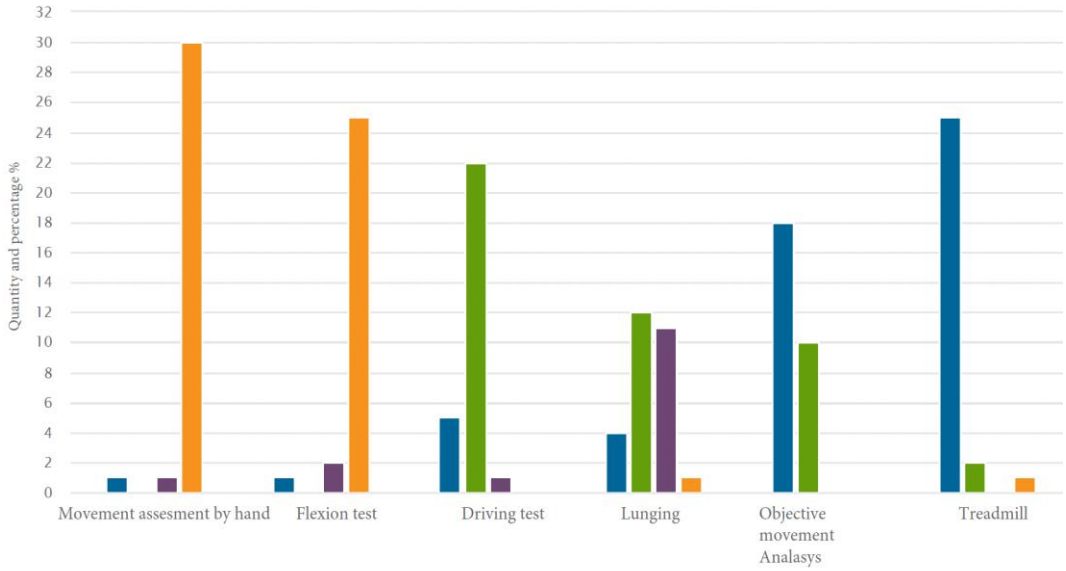
Figure 11. Geographic spread – veterinarians.

Quiring how many years of experience the veterinarians had of working with trotting horses the outcome was; 22% had 0-5 years, 10% 5-10 years, 14% had 10-20 years and 51% had more then 20 years of work experience with trotting horses, 2% responded that they did not work/ had worked with trotters and where then terminated from the survey. When asked about the nature of employment 63% answered that they were employed by a company, 32% where self-employed in their own business and 10% stated that they had another employment situation. The respondents got to estimate the percentage of trotting horses of their total clientele and the result was an average value of 47.2% trotting horses. When asked if the respondents specialized in any field in veterinary medicine 37% said no, 56% orthopedics, 14% airways, 2% cardiology, 5% intern medicine and 12% stated that they specialized in "other" field. It was possible to choose more than one answer to this question. One question was if the veterinarians had a specialist degree in veterinary medicine, 62% said no, 31% had a Swedish residency, 3% a diplomat and 8% other.

5.2.2 Page 2: The trotting horse as a patient

This page of the survey focused on questions regarding injury prevalence and diagnostics in the trotting horse. In a multiple-choice question asking what the most common medicinal problem in trotting horses were, 100% of the respondents stated it was orthopedic related problems, second most experienced problem was airways with 24%. It was possible to choose more than one answer to this question. To the question what the most common cause of lameness was 94% stated joint inflammation second most common to tendon/ligament injuries with 5% and 1% other. When the veterinarians were asked to estimate how many of the trotting

horses that displayed lameness initially when examined, the average value was 48.2%. In order to find out how different types of diagnostic methods were used in movement assessment the respondents got to rate different methods and how often they were used. Movement assessment by hand seemed to almost always being used, the diagram below presents the full result (Figure 12).

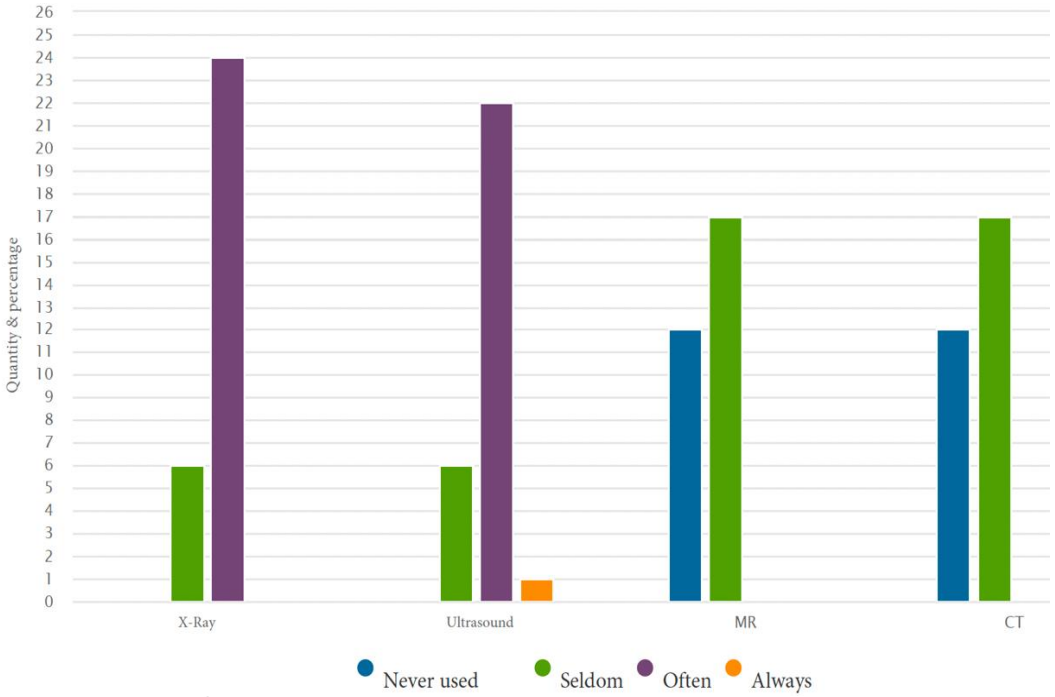


	Never used	seldom	often	always	Total
Movement assesment by hand	1 (3%)	0 (0%)	1 (3%)	**30 (94%)**	32
Flexion test	1 (4%)	0 (0%)	2 (7%)	**25 (89%)**	28
Driving test	5 (18%)	**22 (79%)**	1 (4%)	0 (0%)	28
Lunging	4 (14%)	**12 (43%)**	11 (39%)	1 (4%)	28
Objective movement analasys	**18 (64%)**	10 (36%)	0 (0%)	0 (0%)	28
Treadmill	**25 (89%)**	2 (7%)	0 (0%)	1 (4%)	28

Figure 12. Movement assessment veterinarians, the result from the table is illustrated in the top diagram, the total values represent the total responses to each option.

The question "*How often do you use diagnostic analgesia before intra-articular treatment of an orthopedic problem?*" resulted in 28% stating always, 56% often, 9% seldom, 3% never and 6% other. Multiple answers where possible for this question. Following query tested during what type/types of movement assessment the analgesic was evaluated. Multiple answers where available resulting in 97% movement analysis by hand, 45% driving test, 65% lunging, 23% objective movement analysis and 6% treadmill.

The respondents were asked to rate how often they used different types of diagnostic imaging. X-ray and ultrasound were often used by a majority of the veterinarians whereas MR and CT were used more rarely or not at all, the full result is presented in the diagram below (Figure 13).



	Never used	Seldom	Often	Always	Total
Xray	0 (0%)	6 (20%)	**24 (80%)**	0 (0%)	**30**
Ultrasound	0 (0%)	6 (21%)	**22 (76%)**	1 (3%)	**29**
MR	12 (41%)	**17 (59%)**	0 (0%)	0 (0%)	**29**
CT	12 (41%)	**17 (59%)**	0 (0%)	0 (0%)	**29**

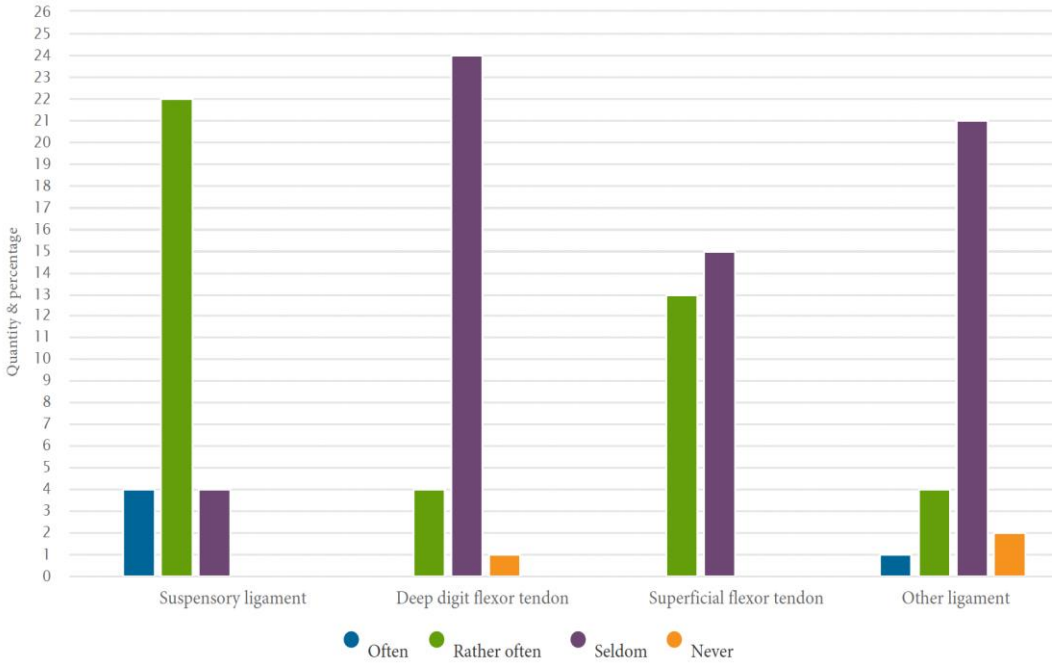
Figure 13. Diagnostic imaging used by veterinarians, the results from the table is illustrated in the diagram, the total values represent the total responses to each option, and the percentage is within parentheses.

One question contained alternatives where the veterinarians rated how often different joints were treated, also here treatment to the carpal joint was the most frequent option chosen, the full outcome is presented in the table below (Figure 14).

	Often	rather often	seldom	never	Total
Carpus	**22 (73%)**	7 (23%)	1 (3%)	0 (0%)	**30**
Fetlock front	**15 (52%)**	12 (41%)	2 (7%)	0 (0%)	**29**
Fetlock hind	4 (14%)	8 (28%)	**17 (59%)**	0 (0%)	**29**
Tarsus	1 (3%)	12 (41%)	**16 (55%)**	0 (0%)	**29**
Sl-joint	2 (7%)	3 (10%)	**13 (45%)**	11 (38%)	**29**
Stifle	12 (41%)	**14 (48%)**	3 (10%)	0 (0%)	**29**
Hip joint	0 (0%)	1 (3%)	9 (31%)	**19 (66%)**	**29**
Humeral joint	0 (0%)	1 (3%)	11 (38%)	**17 (59%)**	**29**
Coffin joint front	5 (17%)	10 (34%)	**14 (48%)**	0 (0%)	**29**
Coffin joint hind	0 (0%)	0 (0%)	10 (34%)	**19 (66%)**	**29**
Elbow joint	0 (0%)	0 (0%)	12 (41%)	**17 (59%)**	**29**
Other joint	0 (0%)	1 (3%)	**20 (69%)**	8 (28%)	**29**

Figure 14. Frequency in joint treatments – veterinarians, the number in front of the parenthesis is the number of respondents to each option, the total value represents number of responses to each option.

The survey also contained a question of similar nature as for the joints, where it was possible to rate the occurrence and give the localization of tendon/ligament injuries. Injuries to the suspensory ligament was the most common answer, the full results are presented in the diagram below (Figure 15).



	Often	Rather often	Seldom	Never	Total
Suspensory lig	4 (13%)	**22 (73%)**	4 (13%)	0 (0%)	**30**
DDFT	0 (0%)	4 (14%)	**24 (83%)**	1 (3%)	**29**
SFT	0 (0%)	13 (46%)	**15 (54%)**	0 (0%)	**28**
Other ligaments	1 (4%)	4 (14%)	**21 (75%)**	2 (7%)	**28**

Figure 15. Prevalence injuries tendon/ligaments – according to veterinarians. The result from the table is illustrated in the diagram, the column "Total" presents the total number of responses to each option.

When asked if a lameness was perceived as equal when trotting by hand versus driven at high speed, 21% stated yes, 21% no, 51% sometimes and 7% stated other. To the question if the respondents believed the horse needed to be driven in order to perform a correct movement analysis, 76% said sometimes, 14% thought driving was not necessary, 3% thought it was always necessary and 7% stated "other".

5.2.3 Page 3: Treatments and pharmaceuticals

This page covered questions about what type of pharmaceuticals and treatments the veterinarian used and had preference for in trotting horses. When asked what drug was most the appropriate for treating joint inflammation intra articular cortisone was clearly prevailing, the full outcome was as the table below presents (Figure 16).

1 Cortison 28 days withdrawal	34 (79%)
2 Cortison 14 days withdrawal	13 (30%)
3 Hyaluronic acic	19 (44%)
4 PRP/ACP	13 (30%)
5 IRAP	14 (33%)
6 DMSO (DiMetylSulfOxid)	1 (2%)
7 Stemcells	6 (14%)
8 Other:	6 (14%)
Respons:	43

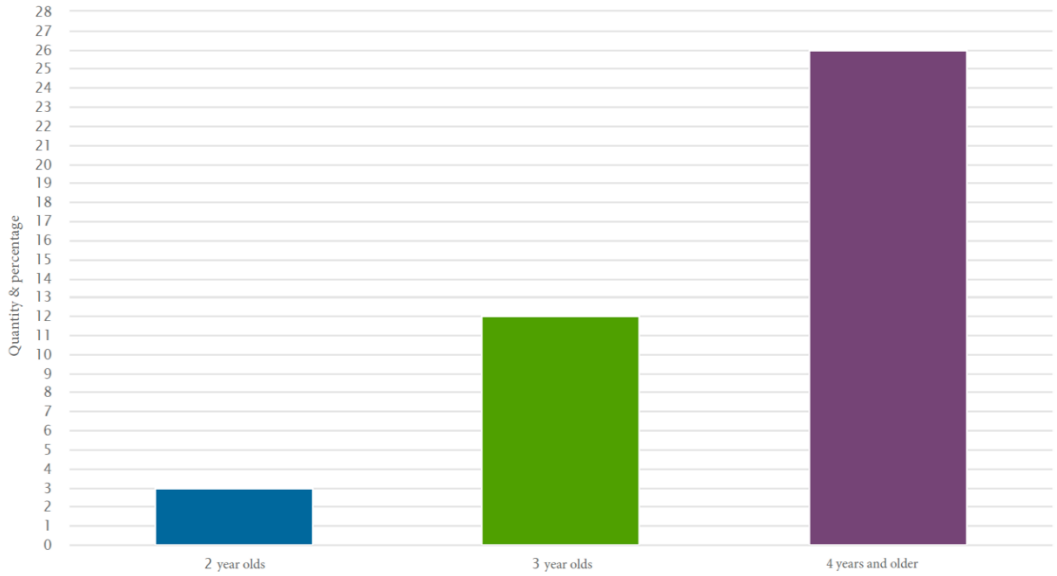
Figure 16. Most appropriate treatment for joint inflammation I.A, according to veterinarians, The respondent was able to choose more than one option, n-value 43.

The respondents got to estimate how often they used different types of preparations presented for treatment of joint inflammation, here cortisone was also the most used drug followed by PRP, the full result is presented in the table below (Figure 17).

	Always used	Often	Seldom	Never	Total
Cortison 28 days	1 (3%)	**26 (84%)**	3 (10%)	1 (3%)	31
Cortinson 14 days	5 (17%)	**16 (53%)**	7 (23%)	2 (7%)	30
Systemic NSAID	2 (7%)	9 (31%)	**15 (52%)**	3 (10%)	29
PRP / ACP	0 (0%)	**12 (41%)**	5 (17%)	**12 (41%)**	29
IRAP	0 (0%)	8 (28%)	**13 (45%)**	8 (28%)	29
Stemcells	0 (0%)	0 (0%)	10 (34%)	**19 (66%)**	29
DMSO	1 (3%)	1 (3%)	5 (17%)	**22 (76%)**	29
Hyaluronic acid	0 (0%)	12 (41%)	**13 (45%)**	4 (14%)	29

Figure 17. Pharmaceuticals used for treating joint inflammation. The number in front of the percentual parenthesis is the number of respondents to each option, the total value represents number of responses for each option.

When asked what age group of horses that was most frequently treated 4-year-olds and older dominated, the result is presented in the diagram below (Figure 18).



1 2 year olds	3 (10%)
2 3 year olds	12 (39%)
3 4 year olds and older	26 (84%)
Svar	31

Figure 18. Age group of horses treated according to veterinarians. The table content is illustrated in the graph, the number in front of the parenthesis shows the number of responses for each option, it was possible to choose more than one option to this question.

The survey showed that 65% said yes to that they would allow the trainer to be involved and influence their decision about which treatment and preparations used, 6% said no, 32% sometimes and 3% other to the same question. The question "*Does it happen that you inject a healthy joint (without initial lameness and flexion test reaction) for preventive purposes?*" resulted in that 83% said no, 7% yes and 13% sometimes. The veterinarians were asked to estimate how many percentages of the trotting horses they treat that needed more than one treatment for the same orthopedic issue, the average value was 43.9% of horses treated. When asked about the routines for rehab plans after joint injections the response showed that most veterinarians stated that they set up a rehab plan for the trainers, the full result looked like the diagram presents (Figure 19).

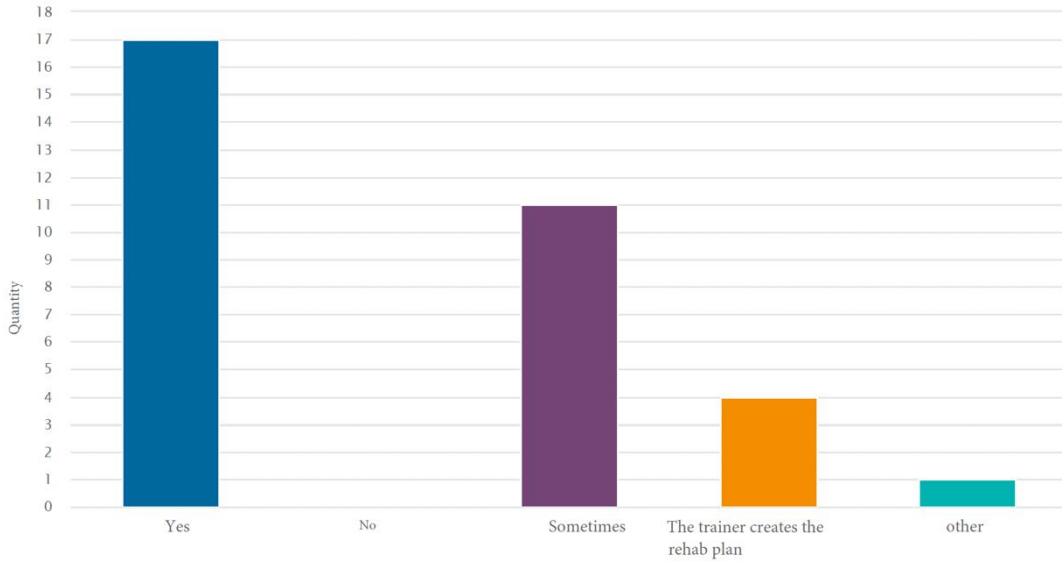


Figure 19. Rehab plan set up by veterinarians, n-value was 28 responses.

The survey asked the veterinarians to rate how many days of rest they administered horses after usage of specific drugs, more than 7 days rest was the most chosen alternative for all drugs but PRP, that has a shorter recommended rest (4-7 days) compared to other pharmaceuticals with prevailing recommended rest of more than 7 days, the full result is shown in the table (Figure 20).

	No rest	1-3 days	4-7 days	More then 7 days rest	I do not know
Cortison	0 (0%)	1 (4%)	10 (36%)	**16 (57%)**	1 (4%)
Hyaluron	0 (0%)	2 (7%)	9 (33%)	**12 (44%)**	1 (4%)
PRP / ACP	0 (0%)	2 (7%)	**9 (33%)**	7 (26%)	1 (4%)
DMSO	0 (0%)	1 (4%)	5 (19%)	1 (4%)	2 (7%)
Stemcells	0 (0%)	0 (0%)	1 (4%)	10 (37%)	3 (11%)
IRAP	0 (0%)	2 (7%)	7 (26%)	**11 (41%)**	2 (7%)

	I do not use the drug	Svar
Cortison	0 (0%)	**28**
Hyaluron	3 (11%)	**27**
PRP / ACP	8 (30%)	**27**
DMSO	**18 (67%)**	**27**
Stemcells	**13 (48%)**	**27**
IRAP	5 (19%)	**27**

Figure 20. Days of administered rest after joint treatment, "Svar" represent the total responses for each pharmaceutical.

When asked if the respondents thought that there was a lack of knowledge among horse veterinarians, who do not usually work with trotting horses, on how the trotting horse moves and how lameness is examined. It showed a clear result that racehorse veterinarians thought that there was a lack of knowledge among other equine vets, the full result looked like the diagram below shows (Figure 21).

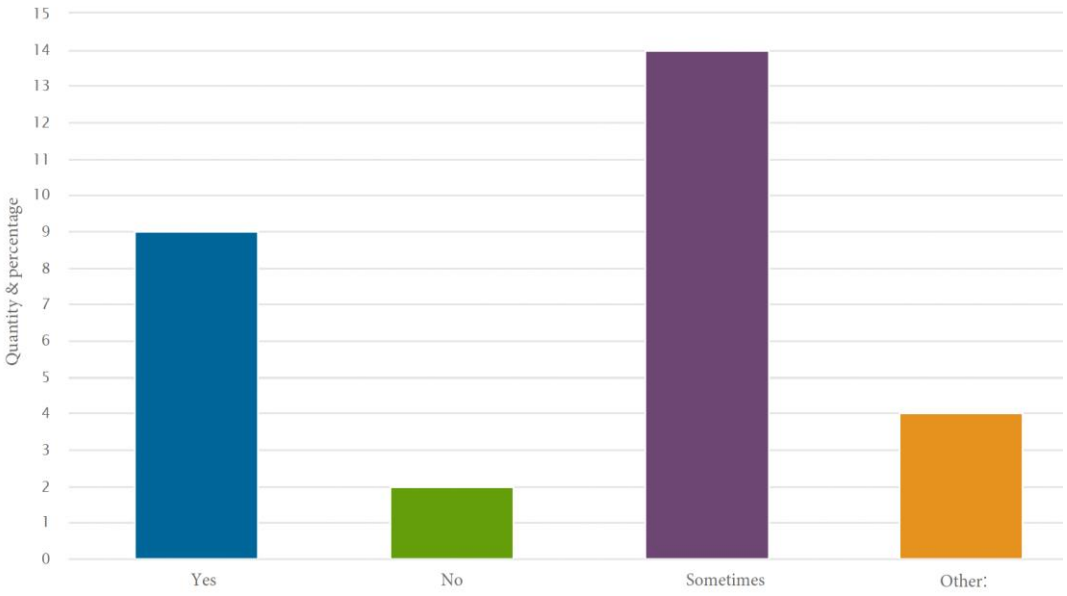


Figure 21. Lack of knowledge in regular horse veterinarians, the n-value was 28 responses, it was possible to choose more than one option to this question.

The question "*At what intervals do you treat a joint that does not respond to the first treatment with the following preparations:"* The veterinarians got to rate the treatment frequency for each drug. Most preparations part from stem cells had an interval time of 0-4 weeks, the full result is presented in the table below (Figure 22).

	From 0-4 weeks	4-6 weeks	6-8 weeks	8 weeks +	Never treat more then once	Total
Cortison 28 days	**20 (83%)**	1 (4%)	0 (0%)	1 (4%)	2 (8%)	**24**
Cortison 14 days	**18 (78%)**	1 (4%)	1 (4%)	0 (0%)	3 (13%)	**23**
Hyaluron	**18 (82%)**	1 (5%)	0 (0%)	1 (5%)	2 (9%)	**22**
DMSO	**6 (60%)**	1 (10%)	0 (0%)	0 (0%)	3 (30%)	**10**
IRAP	**19 (90%)**	1 (5%)	0 (0%)	0 (0%)	1 (5%)	**21**
PRP	**13 (87%)**	1 (7%)	0 (0%)	0 (0%)	1 (7%)	**15**
Stemcells	2 (14%)	1 (7%)	0 (0%)	4 (29%)	**7 (50%)**	**14**

Figure 22. Intervals used for treating joints, the total value represents the responds-rate for each pharmaceutical.

The veterinarians got to rate for different drugs, how many times a joint could be treated for the same problem, the results showed that 2-3 times was the most accepted frequency to treat a joint to be treated, the full result is presented in the table (Figure 23).

	1 times	2 times	3 times	4 times +	Total
Cortison 28 days	1 (4%)	**14 (61%)**	7 (30%)	1 (4%)	23
Cortison 14 days	1 (5%)	**11 (50%)**	8 (36%)	2 (9%)	22
Hyaluron	2 (10%)	**11 (52%)**	5 (24%)	3 (14%)	21
DMSO	3 (30%)	1 (10%)	**4 (40%)**	1 (10%)	10
IRAP	0 (0%)	5 (25%)	**8 (40%)**	7 (35%)	20
PRP	0 (0%)	**8 (57%)**	3 (21%)	3 (21%)	14
Stemcells	**4 (40%)**	**4 (40%)**	1 (10%)	1 (10%)	10

Figure 23. Frequency of joint treatment, the total value represents the responding rate to each pharmaceutical.

The result enquiring what treatments that were used to treat tendon/ligament injuries, resulted in 83% responded conservative treatment (rest), 17% laser, 67% shockwave and 42% injection with pharmaceuticals. It was possible to choose one or more options to the question. Cortisone, PRP and stem cells where the three pharmaceuticals that respondents stated that they used as injected medications for tendon/ligament injuries.

The last question in the survey was a free answer question that asked if the veterinarian had any suggestions on how to improve the diagnostics of orthopedic problems for trotting horses in Sweden. It was a total of 15 written answers submitted in the survey. The dominating answers submitted were the ability for the veterinarian to access race replays, better insurance policies for racehorses that would cover costs for orthopedic problems and more education in veterinary school about racehorses.

5.3 In-depth interviews

A total of 12 A-licensed trainers participated in the in-depth interviews, 9 were performed live out on the trainers' facilities and 3 via a telephone call. The average time consumed for an interview was 2.5 h, that also included some guided showing of the training facilities. The gender distribution were 3 females and 9 males. The age varied from 28 years to 65 years of age. The geographic spread was as following: 3 trainers from Skåne county, 1 from Halland county, 3 from Stockholm county, 2 from Södermanland county, 1 from Dalarna county, 1 from Uppsala county and 1 from Västernorrlands county. The average number of horses in training divided on the 12 trainers were 54.3 horses. Out of the 12 trainers 4 of them had over 100 horses in training. The tracks that the interviewed trainers used for training varied and included were: straight tracks, oval tracks, oval racecourses, deep sand tracks and forest trails. Everyone stated that the horses spent time in paddocks daily. About a third of the trainers seasonally held some horses out in paddocks full time. One trainer had all horses staying outside year around full time. A majority of the horses were insured. It was a clear pattern when questioned about insurance that this did not cover most training related injuries. It was seen as a problem among the trainers.

All the trainers had a cooperation with a specific veterinarian/veterinarians. Out of the trainers all except two had regular visits planned with their veterinarians. They all agreed that certain veterinarians are good in different fields and that they will consult different practitioners for different issues. Citation from a trainer "*A human does not seek medical care from an orthopedic doctor if they have an issue with the throa*t." Out of the 12 trainers 10 agreed that certain diagnoses were associated with certain veterinarians, and that the diagnose they received could vary depending what veterinarian they used. Cited from a trainer *"I have been training for over 25 years, you see diagnoses that were missed back in the day that are now coming to light. In the past there were plenty diagnoses to the coffin joint now some SI-joint problems are being diagnosed."* By saying so he meant that some veterinarians would find certain diagnoses and that diagnostic trends could be seen in the general veterinary profession. Another trainer cited on the same subject *"Some people do not want to be mainstream, if meat is served as the dish of the day, some people will choose fish just to stand out. The same applies to veterinarians who want to find a unique diagnosis."* In the medical records shared from some trainers there were certain diagnoses that were associated with certain veterinarians. Three trainers that used the same veterinarian had frequent treatments on their horses to the SI-joint, this was rarely seen in the rest of the trainers' horses. One trainer had a majority of diagnosed inflammation and treatment to the elbow joint, this localization was not seen in any of the other trainers nor in the survey study. There was also a clear pattern in showing that certain veterinarians favored certain preparations for

treating joint inflammation. The most used preparation was 28- and 14-day withdrawal cortisone. PRP and HA was the second most used drug for joint injection. The use of DMSO was seen in all trainers interviewed in Skåne county and only used in one trainer from the other counties. Around half of the trainers preferred not using cortisone on the 2- and 3-year-olds. Alternative options to cortisone were PRP, HA and DMSO. Arguments for not wanting to use cortisone was raised as that the withdrawal times were too long, and that cortisone was perceived as cartilage damaging.

All trainers in the group agreed that it was important to have a close collaboration and ability to influence on what and where treatments were administered by their veterinarian. It was clear that it was important to be able to consult with the veterinarian about treating the horse in timing to its race plan. When the question was raised if they could consider using a regular horse veterinarian it was clear that the majority thought that a practitioner without experience with trotting horses lacked the understanding of diagnosing a trotting horse. A pattern was seen that these veterinarians were perceived to take longer time (for diagnosing/treating) the horse and that it often was more expensive for the same type of work as a trotting horse treating veterinarian would perform. Another negative side that was brought up, of using these veterinarians not normally treating trotters, was the opinion of inadequate understanding for withdrawal times and to get the horse ready for targeted races. One trainer said "*I would never go to a riding horse vet, they would never understand and I would probably be ruined.*"

When it came to diagnosing lameness the movement assessments used varied. Movement assessment by hand, treadmill, driven test, lunging and objective movement analysis were described. Some trainers expressed that most veterinarians they consulted used diagnostic analgesia from time to time, while 4 of the trainers described that their veterinarians did not use diagnostic analgesia at all. Orthopedic problems were exclusively seen as the most common health problem in the horses. When touching the subject about different types of shoeing, the trainers agreed that it was important with balancing the horse right in order to stay sound. One trainer said *"There is an issue that we in the trotting sport can make the lameness go away by balancing differently."* The trainer meant that balancing was good but could also be masking a lameness problem.

There was a clear opinion that carpus was the most frequently treated joint. All but one of the trainers estimated that 50-75% of joints treated in their horses were carpus. There was also an agreement that carpal joint inflammations often were bilateral. Some trainers liked to see a carpal inflammation treated bilateral regardless of if a diagnosis could be made on both carpal joints or not. One trainer said "*If only the one carpus is injected, the other one is going to be inflamed in the near*

future.” Other frequently seen diagnoses of joint inflammation were stifle joints, front fetlocks and front coffin joints. An observed pattern was that the trainers that used hill training and deep sand tracks perceived that their horses had the stifle joints injected more frequently than the trainers using straight or oval tracks. This pattern was also seen when comparing medical records.

When the interview touched the subject of rehabilitation, a vast majority said the veterinarian gave guidelines, but it was up to them as a trainer to plan the rehabilitation.

The interview ended with asking how the trainers perceived the general welfare of trotting horses in the country. All of the trainers thought that the trotting horses lived in a good environment in Sweden.

6. Discussion

This study confirms that orthopedic injuries are the most common medical problems in Swedish trotting horses, just like in other race horses (Vigre *et al*. 2002). Prevalence, treatment and diagnostic procedures were investigated in three steps through questionnaires and in-depth interviews of trainers and veterinarians.

6.1 Demographics and background

Among both veterinarians and trotting horse trainers participating in the study, an even geographical spread was achieved. Age and years of experience also appear to have an even coverage. There was a dominance of women participating in both the survey studies, with 66% in the trainers' survey and 71% in the veterinarian study. Meanwhile the in-depth interviews only had 25% women. The majority of women participating in the trainers-survey is not representable to the gender division in reality, since there is a male dominance in the licence holding trainers in Sweden (Svensk Travsport 2022a). There has been no data found available for the gender distribution in trotting horse treating veterinarians, although there was a male majority among the veterinarians that were stated to be treating the horses among the trotting horse trainers who participated in the interviews. The distribution of the survey should have been at an equal reach for women and men. It can be speculated in why women may be more inclined to participate in survey studies. Regardless of the speculation, the gender distribution of the study can affect actual conditions and the liability of the study. Out of approximately 3,000 trotting horse trainers in Sweden around 6.5 % participated in the survey. It is not possible to know how many out of the total question population of veterinarians that participated in the survey since how many veterinarians that was questioned is not known. There is a possibility that several types of bias could have occurred in the survey. Response rate bias is a vulnerability when using the method of an optional survey. It is a risk that the individuals that choose to participate in the survey have a strong cause to do so. It can for example be that these individuals have an extra motivation to improve equine health or that these individuals are unsatisfied about a certain cause. The non-response bias is also a factor. Individuals deciding not to participate can lead to results missing out on a certain type of answers. For example, veterinarians that deviate from treatment guidelines might not be inclined to respond since it is a breach of recommendations. There could also occur a wish-bias among the responses in both the surveys and interviews. Some responses might not be accurate due to that the respondent responds in a way they wish they were acting rather than the choices that reflects reality.

6.2 Prevalence of injuries

It was a consensus in both the group of trainers and veterinarians that orthopedic problems were the most common injuries in trotting horses. It was also clear within the groups that joint inflammation was the most common diagnosis in cause of lameness. In both the survey studies as well as the trainer interviews, inflammation to the carpal joint (carpitis) was seen as the most common diagnose in trotting horses. Following carpitis, inflammation to the joint of the front fetlock, the stifle joint and coffin joint of the front legs were the most common diagnosed and treated joints in the horses within all three groups. In the in depth interviews some outliers of diagnosis were seen. Three A-licensed trainers that used the same veterinarian had SI-joint problems as their top three most treated areas of lameness in their horses. SI-joint was ranked as the sixth most common treated joint in the veterinarian survey and the fifth most common treated joint in the trainers' survey. Another outliner was seen in a trainer from the in-depth interviews that used a veterinarian where the most common diagnosis to lameness was inflammation to the elbow joint. Elbow joint inflammation was described as very rare from both the survey study results. These two outliers in diagnoses could support the theory that certain diagnosis can be trending in certain veterinarians. It could also be a result of that individual type of training could be a cause for certain diagnosis.

It was consensus in all three groups that the most prevalent diagnosis in injuries to ligaments/tendon was injuries to the suspensory ligament followed by injuries to the superficial flexor tendon.

6.3 Treatments

The study investigated how and with what pharmaceuticals orthopedic injuries were treated. Some of the results were consistent between the groups meanwhile some parts of the results seem to be varying. Cortisone with a 28-day withdrawal time was the most frequent used drug to treat joints within all three groups, this was followed in popularity by cortisone with a 14-day withdrawal time, hyaluronic acid was also a popular drug of choice within the groups. The results from the trainers' survey showed that DMSO was the fourth most used drug, but that PRP was not very frequently used for joint injection. According to the veterinarians DMSO was barely used at all and PRP was the fourth most preferred drug for joint injections. When looking at what the trainers stated in the in-depth interviews and what the medical journals from those trainers that said both PRP and DMSO were used, it is possible that the variation in results between the groups is due to the study not having enough representative veterinarians for what veterinarians that treat the largest quantity of trotters. From the in-depths interviews the use of DMSO was

shown to be more localized to the southern part of the country, the geographic concentration of this treatment may have been caused by certain veterinarians in the area that favours this drug for treatments of orthopedic problems. It could also be because veterinarians in the southern part of the country are more influenced by treatments used on the continent in Europe. A factor why the veterinarian survey did not show that DMSO were used for joint injections could be because it is not a drug that is recommended for joint injections according to SVF-guidelines and that veterinarians do not want to state using a treatment that is not fully accepted according to guidelines. This could be a cause of wish-bias or non response-bias. It is an unexpected result that DMSO was so frequently used to treat joints when it is not recommended for joint injections by SVF (Hästsektionen 2021). Maybe the veterinarian survey lacked responses from some of the veterinarians that cover the most performed treatments on trotting horses in Sweden. This theory could be supported by that the majority of veterinarians from the survey were employed whereas the veterinarians treating trotting horses out on the trainers' facilities seemed to be self-employed.

The results for what treatments were used to treat tendon/ligament injuries resulted in a consensus that conservative treatment was the most applied. Laser, the second most stated treatment in both the trainers' groups was not a popular treatment in the veterinarian survey. A reason for this could be that a lot of therapy alternative to a veterinarian care have access to perform laser treatments. It was seen in the trainers' survey and in the in-depth interviews that it was very common with other alternative care other than a veterinarian. The results also showed that some horses were treated with cortisone injections to treat tendon and ligament injuries. Some studies suggest that this could cause harm to the structure and predispose for rupture of the tendon or ligament (Lu *et al*. 2016).

The results for what age group of horses that were most frequently treated for orthopedical problems, there was a clear agreement that horses of 4 years and older were the population that was most frequently treated. The results showed an increasing of treatments as the horses got older. This result could possibly be explained because the strain on the joints becomes more frequent and worn as the horse gets older.

6.4 Diagnostic methods

The survey researched how movement analysis was performed to diagnose orthopedic injuries. Movement test by trotting the horse by hand was the most used method in the three groups. This would probably be because it is an easy-to-use standardized method of examination. What differed the results within the groups

were that veterinarians said that they used objective movement analysis more than the two trainer groups. A majority of interviewed trainers explained that an objective movement analysis was taking too long time and difficult to perform out on the trainers' facilities, this was also the most common place for the veterinarian to be performing the examination.

The results of how often diagnostic analgesia was used to diagnose showed different results between the groups, (84%) of veterinarians used it always or often, compared to the trainers that stated that their veterinarian used diagnostic analgesia in (66%) of the time as always or often. To not use diagnostic analgesia before intra articular injection deviates from the Swedish guidelines by SVF (Hästsektionen 2021). It is astonishing that many treatments seem to be deviating from what is recommended in Sweden. The different results between the trainer and veterinary survey regarding movement analysis and diagnostic analgesia could be because of a selection bias in the veterinary survey. Maybe could it be that it was a slightly different group of veterinarians participating in the survey then the veterinarians actually treating large parts of the Swedish trotting population. As the survey was emailed out to equine hospitals and clinics it is possible that a majority of the clinicians participating were working at a clinic. Practicing at a clinic could conceivably easier facilitate performing an objective movement analysis, as well as performing diagnostic anesthetics, compared to veterinarians who work out in the field. Practicing at a clinic generally also comes with more monitoring of what methods that are used. It could be possible that this is the reason why the veterinarians from the survey used more diagnostic analgesia and their absence from treating joints with DMSO.

6.5 Choice of veterinarian

The results in all three groups showed that it was a clear majority that thought that veterinarians that do not frequently work with trotting horses have a lack of understanding for how and what the trotting horse demands in orthopedic treatments. It can be believed that the competence in a certain area exceeds with experience or that there is a lack of knowledge about racehorses in the general horse veterinarian. The theory of this could be that there is a lack of education at the veterinary program held at the Swedish Agricultural University that is the solitary university that facilitates a veterinarian education in Sweden. This argument is also supported and discussed in the discussion of free answers below.

6.6 Free answers

The research gave all three groups the possibility to answer the question on how the orthopedic health could be improved for trotting horses in Sweden. A theme that was common from all populations, were that it would be an improvement if insurances covered more of the veterinary costs related to orthopedic injuries. Trotting horses, unlike most hobby horses, serve a purpose of earning money and are operating in businesses (Swedishhorseracing 2022). A theory could be that people who owns horses used for leisure are more prone to pay higher expenses for insurances with a broader coverage. For the trotting horse, the insurance needs to be affordable in order to balance costs and earnings. It is believed that an insurance that would cover more costs could encourage the trainers as well as the veterinarians to be more thorough with the diagnostics.

Communication between the trainer and the veterinarian was on the demands list of the answers given from the trainer groups. Veterinarians gave free answers about more education about racehorses. It could be believed that an increase of knowledge about racehorses in veterinarians would lead to an increased understanding and better communication with the trainers.

The trainer groups and the veterinarian group both expressed that access to race replays could lead to better orthopedic health in trotting horses. ATG who is owned by the Swedish trotting racing authority (Svensk Travsport) and the Swedish thoroughbred racing authority (Svensk Galopp), are also the main streaming service of racing in Sweden and they are the ones that enables race replays. To access race replays more than 7 days old, a fee needs to be payed (ATG 2022b). As ATG is owned by the racing authorities it could be of opinion that it is in the companys interest to care for an improvement of the health in racehorses. A thought for improvement in veterinary care could be that veterinarians could hold free access to the replay archive.

6.7 Shortcomings and improvements of the study

When planning the research, it was in the plan to perform in-depth interviews with veterinarians as well as trotting trainers. Due to lack of time and resources the veterinarian interviews were not executed. To complete in-depth interviews with the trainers gave the study possibilities to answers questions on why certain result looked like they did. This led to a broader understanding and a possibility to make more valid conclusions. In-depth interviews with veterinarians could have led to better quality and some questions regards veterinarian choices could have simpler been explained.

The veterinarian survey submitted 49 responses. It would have been desirable to get a higher response rate. It was difficult to get in contact with the veterinary clinics and individual veterinarians to participate in the survey. Many who were contacted never replied or participated. This could have led to a selection bias. It is possible that the veterinarians with a high workload deviated from participating.

The trainers' survey submitted 227 responses. It was a majority of B-licensed trainers that participated. The shortage of A-licensed trainers in the survey was seen to be attempted to be balanced with the in-depth interviews only containing A-licensed trainers. In both of the survey studies it was seen that not all respondents chose to answer all of the questions in the survey. Many of the participants were still seen to be answering a sufficient number of questions enough to be included in the study. This was seen as something that could have affected the results. Some respondents to the veterinarian survey were failing to answer questions towards the end of the survey, much more so than in the trainers' survey. Maybe is it so that the veterinarians had a lack of time participating or that they did not find the survey interesting. It could also be that certain questions were avoided. However, this shortcoming of replies could have affected the result. The survey could have been improved with more condense and fewer questions. If the survey was shortened it could possibly have led to more respondents fulfilling all of the questions in the survey.

In depth-interviews were seen to add a great value to the study. It was possible to follow up with questions where an understanding was difficult to reach. It also gave the opportunity for trainers to lift what they thought was of importance. All trainers contacted but one was happy to participate in the study. A shortcoming from the in-depth interviews was that not all trainers had the will or time to share their medical journals. Out of 12 trainers, 5 could share complete medical journals and 2 trainers could share partially medical journals. It would have added value to the study to obtain more data from medical journals. It would also have made the study more trustworthy if resources and time would have allowed more trainers to be interviewed.

7. Conclusion

This study is, as far as the author knows, the first study to map the prevalence, treatments and diagnostics of orthopedic injuries of trotting horses in Sweden.

The study points out that orthopedic problems are the most common injuries that require veterinary care for trotting horses in Sweden. Carpitis was seen as the most common diagnose to orthopedic problems and joint injections were the most prevalent treatment. The choice of treatment and diagnostics were seen to vary among individual veterinarians. Some treatments and diagnostic methods used in trotting horses were deviating from the guidelines set up by SVF. It can be questioned whether some treatments and diagnostics performed are the most effective and suitable for the individual trotting horse. It would have been of interest to know the motivation for using these treatments and why certain guidelines have been ignored. A more detailed opinion from these veterinarians could be of value to understand why guidelines are breached to evaluate whether it is ignorance of the guidelines or other believes in science, previous experiences or knowledge that is the reason for the disruptions. It is possible that these veterinarians possess other knowledge and experiences that could explain the choices made.

The study showed that many veterinarians that treat a large number of trotting horses operates in self-owned businesses. To retrieve more data from these veterinarians as well as the possibility of regularly retrieved medical records from trotting horses racing in Sweden could increase the value and further the development and mapping of orthopedic injuries in Swedish trotting horses.

References

Armstrong, P., Wastie, M. & Rockall, A.G. (2009). *Diagnostic Imaging*. Hoboken, United Kingdom: John Wiley & Sons, Incorporated. http://ebookcentral.proquest.com/lib/slub-ebooks/detail.action?docID=589213 [2022-10-18]

ATG (2022a). *Trotters.* https://www.swedishhorseracing.com/about/trotters/ [2022-09-19]

ATG (2022b). *ATG - Spel på Sport, Häst och Casino*. https://www.atg.se/ [2022-11-23]

Bassage, L.H. & Ross, M.W. (2003). Chapter 10 - Diagnostic Analgesia. In: Ross, M.W. & Dyson, S.J. (eds.) *Diagnosis and Management of Lameness in the Horse*. Saint Louis: W.B. Saunders. 93–124. https://doi.org/10.1016/B978-0-7216-8342-3.50017-6

Bertuglia, A., Bullone, M., Rossotto, F. & Gasparini, M. (2014). Epidemiology of musculoskeletal injuries in a population of harness Standardbred racehorses in training. *BMC Veterinary Research*, 10, 11. https://doi.org/10.1186/1746-6148-10-11

Brokken, M.T. (2019). Joint disorders in horses. *MSD Veterinary Manual*. https://www.msdvetmanual.com/horse-owners/bone,-joint,-and-muscle-disorders-in-horses/joint-disorders-in-horses [2022-10-09]

Camargo Garbin, L., Lopez, C. & Carmona, J.U. (2021). A critical overview of the use of platelet-rich plasma in equine medicine over the last decade. *Frontiers in Veterinary Science*, 8, 641818. https://doi.org/10.3389/fvets.2021.641818

Caron, J.P. & Genovese, R.L. (2003). Chapter 85 - Principles and Practices of Joint Disease Treatment. In: Ross, M.W. & Dyson, S.J. (eds.) *Diagnosis and Management of Lameness in the Horse*. Saint Louis: W.B. Saunders. 746–764. https://doi.org/10.1016/B978-0-7216-8342-3.50092-9

Egenvall, A., Nødtvedt, A., Penell, J., Gunnarsson, L. & Bonnett, B.N. (2009). Insurance data for research in companion animals: benefits and limitations. *Acta Veterinaria Scandinavica*, 51 (1), 42. https://doi.org/10.1186/1751-0147-51-42

Goodrich, L.R. & Nixon, A.J. (2006). Medical treatment of osteoarthritis in the horse – A review. *The Veterinary Journal*, 171 (1), 51–69. https://doi.org/10.1016/j.tvjl.2004.07.008

Harkins, J.D., Carney, J.M. & Tobin, T. (1993). Clinical use and characteristics of the corticosteroids. *The Veterinary Clinics of North America. Equine Practice*, 9 (3), 543–562. https://doi.org/10.1016/s0749-0739(17)30385-1

Hillidge, C.J. (1985). The case for dimethyl sulphoxide (DMSO) in equine practice. *Equine Veterinary Journal*, 17 (4), 259–261. https://doi.org/10.1111/j.2042-3306.1985.tb02490.x

HNS, LRF Häst, Svensk Travsport, ATG, Högskolan Dalarna & SLU. (2018). *Hästnäringen i siffror - viktigare än du tror.* Del i projektet Samhällsekonomiska effekter av hästnäringen i Sverige. https://hastnaringen.se/app/uploads/2018/12/hastnaringen-i-siffror-viktigare-an-du-tror-2018.pdf

Hästsektionen, SVF (2021). Riktlinje avseende ”Ledpunktion och ledbehandling vid ortopediska sjukdomar” (2012/06) 2021/02

Jacobs, C.C., Schnabel, L.V., McIlwraith, C.W. & Blikslager, A.T. (2022). Non-steroidal anti-inflammatory drugs in equine orthopaedics. *Equine Veterinary Journal*, 54 (4), 636–648. https://doi.org/10.1111/evj.13561

Keegan, K.G., Dent, E.V., Wilson, D.A., Janicek, J., Kramer, J., Lacarrubba, A., Walsh, D.M., Cassells, M.W., Esther, T.M., Schiltz, P., Frees, K.E., Wilhite, C.L., Clark, J.M., Pollitt, C.C., Shaw, R. & Norris, T. (2010). Repeatability of subjective evaluation of lameness in horses. *Equine Veterinary Journal*, 42 (2), 92–97

Keegan, K.G., Yonezawa, Y., Pai, P.F., Wilson, D.A. & Kramer, J. (2004). Evaluation of a sensor-based system of motion analysis for detection and quantification of forelimb and hind limb lameness in horses. *American Journal of Veterinary Research*, 65 (5), 665–670. https://doi.org/10.2460/ajvr.2004.65.665

Kentucky Equine Research (2018). *Update on DMSO Use in Horses*. https://ker.com/equinews/update-dmso-use-horses/ [2022-11-29]

Lu, H., Yang, H., Shen, H., Ye, G. & Lin, X.-J. (2016). The clinical effect of tendon repair for tendon spontaneous rupture after corticosteroid injection in hands. *Medicine*, 95 (41), e5145. https://doi.org/10.1097/MD.0000000000005145

Riksdagen (u.å.). *Travsportens framtid.* (Motion 2019/20:1559 av Jan R Andersson m.fl. [M]). https://www.riksdagen.se/sv/dokument-lagar/dokument/motion/travsportens-framtid_H7021559 [2022-09-19]

Ross, M.W. (2003a). Chapter 6 - Palpation. In: Ross, M.W. & Dyson, S.J. (eds.) *Diagnosis and Management of Lameness in the Horse*. Saint Louis: W.B. Saunders. 42–60. https://doi.org/10.1016/B978-0-7216-8342-3.50013-9

Ross, M.W. (2003b). Chapter 8 - Manipulation. In: Ross, M.W. & Dyson, S.J. (eds.) *Diagnosis and Management of Lameness in the Horse*. Saint Louis: W.B. Saunders. 74–81. https://doi.org/10.1016/B978-0-7216-8342-3.50015-2

Svensk Travsport (2022a). *Den svenska travsporten*. https://www.travsport.se/svensk-travsport/travsporten-i-sverige/den-svenska-travsporten/ [2022-09-19]

Svensk Travsport (2022b). *Tävlingsreglemente.* https://www.travsport.se/siteassets/regelverk/tavlingar/tavlingsreglemente.pdf [2023-01-15]

Vigre, H., Chriél, M., Hesselholt, M., Falk-Rønne, J. & Kjaer Ersbøll, A. (2002). Risk factors for the hazard of lameness in Danish Standardbred trotters. *Preventive Veterinary Medicine*, 56 (2), 105–117. https://doi.org/10.1016/s0167-5877(02)00158-7

Wu, P.I.-K., Diaz, R. & Borg-Stein, J. (2016). Platelet-rich plasma. *Physical Medicine and Rehabilitation Clinics of North America*, 27 (4), 825–853. https://doi.org/10.1016/j.pmr.2016.06.002

Zanotto, G.M. & Frisbie, D.D. (2021). Current joint therapy usage in equine practice: Changes in the last 10 years. *Equine Veterinary Journal*, 54 (4), 750-756. https://doi.org/10.1111/evj.13489

Popular science summary

Equine sport is the third largest sport in Sweden with an estimated number of 350,000 horses in the country. Trotting racing is the biggest branch in the Swedish equine industry, around 80,000 of the population are included in the branch. Trotting racing is a gambling sport where the horses race for price money. It means that good performance is rewarded with earnings. Professional or amateur licensed trotting horse trainers are responsible for the training of the horses. The horses are trained intensely to run at high speed. The athletic performance can lead to injuries and orthopedic injuries are the most common type of injury in racehorses.

Veterinarians are phased with a wide range of treatment and diagnostic options in the field of orthopedic injuries. There are several ways to reach a medical diagnose and a wide range of medicines to use for treating these types of injuries.

This study aimed to map the prevalence, diagnostics and treatments in orthopedic injuries for trotting horses in Sweden. As far as the author knows, this is the first research to study the subject. This study was done by two different survey studies aimed to trotting horse trainers and racehorse veterinarians. In-depth interviews with professional trotting horse trainers were also made and included in the results. Medical journals from the trainers participating in the in-depth interviews were used in the study. The survey-studies as well as the interviews contained questions about what type of injuries that are the most frequent, what methods that were used to diagnose and what medicines that were used to treat orthopedic injuries.

The results showed that inflammation to the carpal joint was the most occurring diagnose and cortisone was the most used medicine for treatment. The results also revealed that certain diagnoses seemed to be trending in specific veterinarians, as well as certain treatments. What was interesting in the result was that some ways of diagnosing and medicines used to treat injuries strayed from treatment guidelines set up by the Swedish Veterinary Association (SVF). In order to get more reliable results and answer some questions motivating the choice of treatments and diagnostics, more veterinarians would need to be questioned in addition to in-depth interviews with racehorse veterinarians.

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