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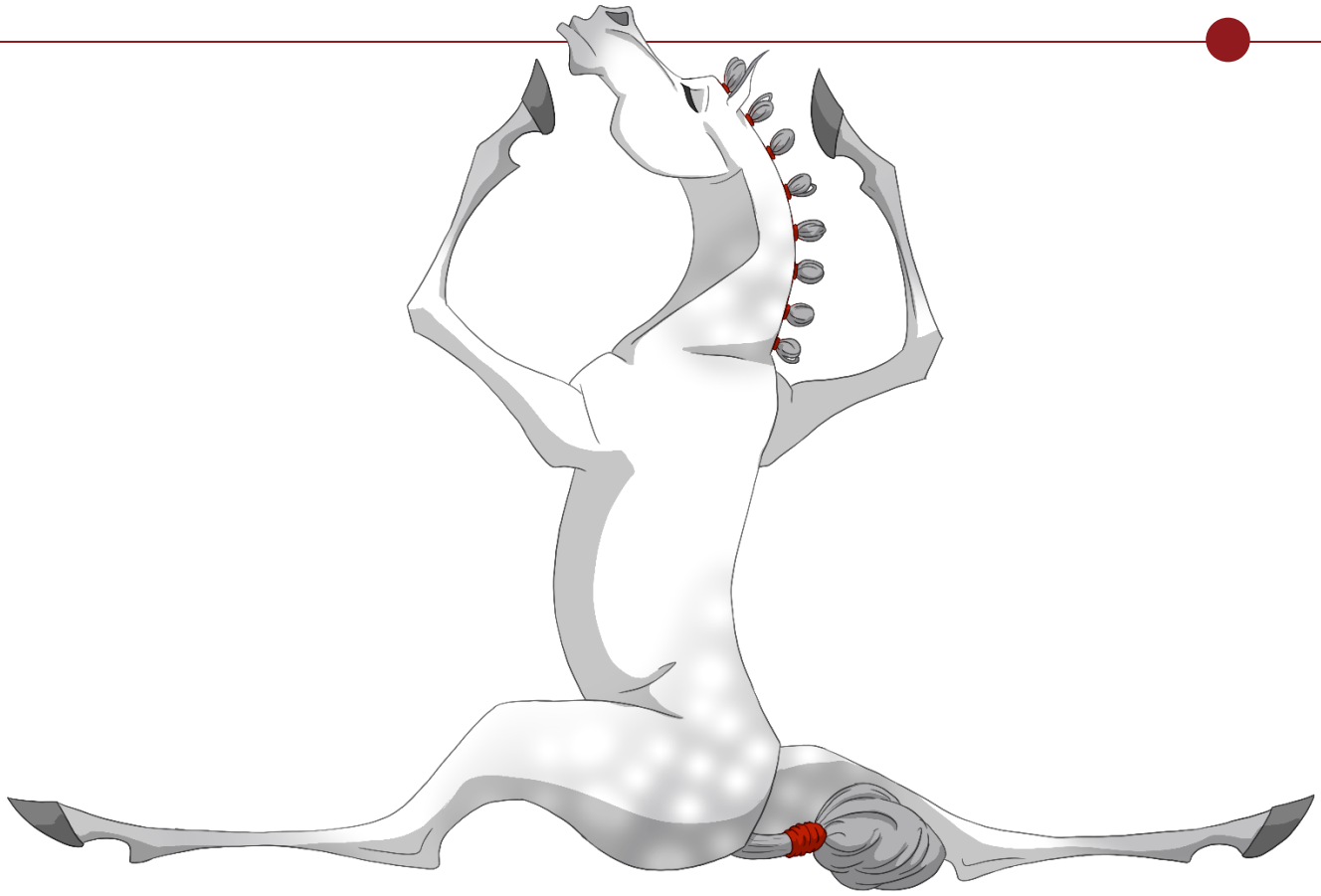

Project outside the course scope

15 ect points

Hypermobility in Horses

An Analysis of Incidents

Supervisor: Adrian Paul Harrison

Submitted on: 12 August 2022

Name of department:	SUND
Author(s):	Malene Leth Flyttov Jørgensen (VJT597)
Title and subtitle:	Hypermobility in horses; an analysis of incidents
Topic description:	Study on hypermobility in horses using mfBIA, AMG and physiotherapist assessments, analysing and comparing the data collected using the different methods.
Supervisor:	Adrian Paul Harrison
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Malene Leth Flyttov Jørgensen

How it started…

It all started when I heard an equine physiotherapist talking about modern horses being more fragile because they were born with flashy gaits and no strength, and it was probably because of hypermobility. Studying animal science where welfare, and especially prevention of decreased welfare like injuries and stress is in focus, I found the topic of hypermobility very interesting. As there is hardly any data on the subject, I thought that this was an area where I would be able to contribute.

Thanks to …

My family, my supervisor Adrian Paul Harrison and all who participated in making this study possible.

Abstract

Background: Equine hypermobility is an overseen area with very little scientific data. In order to better understand hypermobility in horses, this study wanted to compare the hypermobility assessments from equine physiotherapists with measurements done by mfBIA (multi frequency bioimpedance analysis), to see if a comparison truly can be made. mfBIA is not an ideal way of measuring hypermobility in horses, as the method requires the horse to be in box rest for 24 hours. To find an easier method this study also wanted to compare data from mfBIA with data from AMG (acoustic myography). Data from the physiotherapists equine patients were also collected for further analysis in this study.

Results: mfBIA were used to measure hypermobility in horses based on muscle activity in the *gluteus medius* and were compared to three equine physiotherapists assessments on the horses' joints. mfBIA and physiotherapists had the same assessment of 12 horses 42%-67% of the time, with an 17% agreement between the physiotherapists themselves. The mfBIA data were compared to the results from the AMG data in 40 horses and had a 5% agreement. Data from 226 horses were collected by physiotherapists, with their assessment on the horse's hypermobility status, and 33% horses were assessed as being 'whole body' hypermobile.

Conclusion: The physiotherapists' assessment may be too subjective to compare with the mfBIA measurements. For mfBIA and AMG measurements the *gluteus medius* may not be a reliant muscle, therefore studies on other muscles groups needs to be done to test for hypermobility using mfBIA and AMG.

Contents

1. Introduction

Equus ferus caballus, also known as the modern horse, is a popular animal in Denmark, with around 175,000 animals (Kæledyrsguiden, u.d.). The horse is mainly used for sports and hobby, which can be demanding for the horse's body, and result in a higher rick for injuries if the horse is not conditioned to do the required work.

In conversations with equine physiotherapists, it became clear that they had a suspicion that hypermobility may be an overlooked factor in horses with injuries or general problems with rideability. Hypermobility or joint hypermobility, as it is often referred to in humans, may be a risk factor for muscle damage, as some injuries may be caused by the muscles being overworked due to hypermobility in the joints. This has not been documented, and there is not a lot of research on hypermobility in horses, making it hard to assess the extent of injuries caused by hypermobility and the general impact on sport and hobby horses.

1.1 Aim

The aim of this report is to understand more about hypermobility in horses and try to assess how widespread it is in the Danish horse population.

There will be looked at three physiotherapists assessment of hypermobility in horses, based on their palpation of the joints. These results will be compared with results from multi-frequency bioimpedance analysis (mfBIA) based on muscle activity. Measurements from mfBIA will be compared to acoustic myography (AMG) measurements, which are also based on muscle activity.

This study will be looking at what can be defined as naturally occurring hypermobility, which is not dependent on a disease, other symptoms, or injury. It is genetic (Hakim, et al., 2004) and assumed hereditary and is referred to as generalized hypermobility in human medicine. Therefore, horses will be assessed as hypermobile based on their joints or muscles, and it will affect the whole body of the horse.

Hypothesis

I. mfBIA can be used to assess hypermobility in horses.
II. AMG can be used to assess hypermobility in horses.
III. Can Physiotherapist assessment of hypermobility in the horses' joints be compared to muscle measurements done by mfBIA.

2. Background

Hypermobility is often defined by the joints' range of motion, where hypermobility is considered as an extreme flexion or extension of the joint, exceeding the normal spectra of motion. The tightness or restraint from the ligaments determine the range of mobility in a joint, the cause of hypermobility is often ligamentous laxity which is affected by the fibrous protein genes. The genes that encode collagen, elastin and fibrilin are most important (Grahame, 1999) in hypermobility. This supports the theory, set by this study, that natural occurring hypermobility affects the whole body, and not just a single joint.

Both in the human and equine world, hypermobility is an overseen area. In humans it can be a symptom of disorders in the connective tissue, as seen in Ehlers-Danlos syndrome, Marfan syndrome, osteogenesis imperfecta and benign joint hypermobility syndrome, which is clinic-ascertained through the nine-point Beighton score test. Or it can be community-ascertained where it is not seen as a disorder but can be perceived as merely the upper range of the joint's abilities to bend and may suggest that hypermobility represents a 'fitness factor' in these cases (Hakim & Grahame, 2003).

With symptoms like fatigue, anxiety, and chronic pain it is of great importance that we get a better understanding of hypermobility in horses and see if a parallel can be drawn between humans and equines.

When hypermobility becomes symptomatic it becomes a syndrome, many subjects (human) with hypermobility have a life with few or no problems and have no symptoms, but unaccustomed physical exercise may cause problems for subjects with hypermobility (Grahame, 1999). In sports, hypermobility may pose a risk-factor when joints and muscles are pushed to their limits, because of the demand of stretching further, running faster or being stronger. For human athletes, hypermobility has been shown to be a risk-factor for injuries in the upper limb (Jindal, et al., 2016).

Hypermobility is documented in humans, and studies have been made with athletes such as ballet dancers (McCormack, et al., 2004) (Klemp & Learmonth, 1984), jazz dancers (Skwoit, et al., 2019), and shows that hypermobility poses an increased risk of injuries in football players (Konopinski, et al., 2015). Studies suggest that hypermobility is more common in dancers and can be present even in joints that are not normally trained, and thereby encouraged, to be hypermobile (McCormack, et al., 2004) indicating a difference between 'local' and 'whole body' hypermobility. The training for increased flexibility may pose a risk factor for injuries in hypermobile dancers (McCormack, et al., 2004), and the risk of injuries in professions that favors

hypermobility, like ballet and dance, is significantly higher (Klemp, 1997). Horses competing at the highest levels could be compared to human athletes, as the horses are trained to perform to the maximum of their abilities, and in some disciplines the horses are encouraged and trained to increase the flexibility of their joints.

Forced hypermobility, or local hypermobility, can be acquired through repetitive activities, injuries and diseases that affects the joint (Klemp, 1997). This type of hypermobility is not inherited, and the connective tissue is still able to protect the subject against injuries (Grahame, 1999). Forced hypermobility will need the muscles and ligaments to warm up, before the hyper flexion or extension can be done, which is not necessary in naturally occurring hypermobility (Klemp & Learmonth, 1984).

2.2 Possible problems related to hypermobility

According to the National Equine Health Survey (Slater, 2016), one third of all recorded health problems in horses in England was lameness. Of these, 41.1% were degenerative joint diseases, 5 % flexor tendon injuries and 6.1% suspensory ligament injuries. In 2013, the percentage of horses suffering from lameness was 18.6% (Slater, 2013), in three years the percentage had increased to 32.9% in 2016, representing an increasing problem in the equestrian world.

In humans, hypermobility presents a greater risk for ligament injuries, recurrent dislocation of the patella, recurrent knee and ankle effusions and premature osteoarthrosis (Grahame & Jenkins, 1972). Through major and minor repetitive trauma, hypermobility may also increase the risk of osteoarthritis and damage to the joint (Klemp, 1997).

As hypermobility may increase the risk for injuries, there could be a possibility that some of the cases of lameness in horses from the National Equine Health Survey have a connection to hypermobility. Through personal communication with equine physiotherapists, it became clear that they see an increase in hypermobile assessed horses through the last ten years. This could be a possible explanation for the increase in lameness seen in horses over the years and needs to be investigated.

Through the horse's body the ligaments' role becomes very clear as the ligaments prevent joints from dislocating and prevent straining. In the hindquarters of the horse, the only connection between the pelvis and the sacrum is ligaments (Wyche, 2002). Hypermobility can impair the muscles' ability to produce force, muscle strength can therefore be decreased in hypermobile horses. In humans, findings show that male subjects with hypermobility have less strength in their elbow extensors and knee extensors, compared to the non-hypermobile controls (Jindal, et al., 2016). In a hypermobile horse, it is easy to imagine how the muscles in a joint-

stabilizing area, would tense up because of overuse and as an effort to relieve eventual pain in the area and could lead to muscle damage. Reduced bone mass is also commonly seen in patients with Ehlers-Danlos syndrome and joint hypermobility syndrome (Marco, et al., 2015), and represents a possible risk factor for injuries.

According to Marco et al. (2015), regular physical activity, focused on improving muscle tone and proprioception, may improve joint stability and thereby decrease the risk of bone damage and ligament injuries, as the muscles become stronger. Pasture time of 12 hours or longer helps maintain bone mass and fitness (Graham-Thiers & Bowen, 2013), this could be of vital importance to maintaining these features and reducing the risk of injuries and permanent damage in hypermobile horses. Special exercise programs that reduce the hyperextension of the joints may have an impact on the quality of life as well by reducing the pain.

Another common problem from patients suffering from joint hypermobility syndrome is gastrointestinal complaints (Marco, et al., 2015). This should be taken into consideration when studying horses with hypermobility, as studies by Luthersson, et al. (2009) showed that 53% of the horses in the study were suffering from equine gastric ulceration syndrome, creating an increased need for diets focusing on gastric health.

There can be many problems related to hypermobility, as seen in humans, therefore the importance of further investigation is great, as findings may help horses and their owners to achieve better welfare.

3. Method

In this report hypermobility will be defined as ligamentous laxity and will not be dependent on diseases or other symptoms. The report will be looking at live horses, and measure their muscle activity, based on the theory that hypermobile joints are being stabilized by the muscles. The muscle activity will thereby be increased even when the horses are standing still and relaxing. This can be assessed by using multi-frequency bioimpedance analysis (mfBIA) and acoustic myography (AMG). In this report, hypermobility will be looked at as a trait and not as a symptom of something else. The possible consequences of hypermobility will be investigated and the comparison between the methods used by physiotherapists (joint palpation), mfBIA and AMG (muscle measurements) will be assessed. This report will focus on the type of hypermobility that can be inherited, and not forced or localized hypermobility, as the report utilize the theory that naturally occurring hypermobility affects the whole body and may be more pronounced through selective breeding. Joints with forced (local) hypermobility should still be

stabilized by the ligaments, as these are trained, making the muscle-stabilization unnecessary, and thereby making it difficult to measure through the muscles with mfBIA and AMG.

A total number of 48 horses participated in the mfBIA (n=48) and AMG (n=40) tests, with ages between 4 months and 29 years. See table 4.1 for details. The medical histories of the horses were unknown before the measuring, and their hypermobility status were also unknown beforehand. The horses participating were found by directly approaching the owners and through Facebook, where the owners were told that the horses were needed for an incident analysis. Larger stables were prioritized to make transport easier and to optimize time. A riding school and a stud farm were used, as well as some smaller stables. Information about age, height, breed, gender, and discipline were logged.

3.1 Testing the physiotherapists' assessment of hypermobility in single joints

Three physiotherapists participated in the study. Twelve horses were tested on the same day by all three physiotherapists. They had no previous experience with these horses, and only knew their gender. The horses were tested three at a time, each therapist examined a horse, and moved on to the next one when done. The order by which each therapist examined the horses was random, based on which horse was available until they have gone through every horse. When the first three horses were done, the next three was brought out, and so on. The horses were examined at a grooming station at the stable.

The physiotherapists gave their results to a supervisor and were not told the results of the others. They were not allowed to discuss their findings until after the test was done.

By flexing and extending different joints, the physiotherapists assessed if the joint was hypermobile or not. This method is taught as part of their education and is affected by their individual experience and palpation skills.

The horses used for the test were all warm-blooded horses and included four hanoverian horses, two Danish warmbloods, three westphalian horses, two oldenburgers and one KWPN (dutch warmblood). There were ten geldings, one stallion and one mare, the horses were between 4-8 years old, and all used for dressage. All the horses came from the same stable and owner. The physiotherapists had various years of experience and passed the exam for equine physiotherapists in 2010 (therapist 1), 2017 (therapist 2) and 2000 (therapist 3).

3.2 Testing for hypermobility – multi-frequency bioimpedance analysis (mfBIA) based on whole body assessment

Forty-eight horses were tested with mfBIA, and the owners were told to give the horses a 24-hour resting period with no exorcise before the test. They were fed as normally.

Conductive paste (Ten20; D O Weaver and Co, Aurora, Co 80011, USA) were gently rubbed on two spots on the horses' hindquarters, see figure 3.1, while getting as much skin contact as possible. Four custom made platinum electrodes (10 x 25 mm) were placed on the paste-covered sites, to create an optimal pathway for electricity to pass through the muscle, as previously tested (Bartels, et al., 2015). The electrodes were placed according to the manufacture's recommendations, with the current electrodes placed on the outer points. The precise electrode placement is shown in figure 3.2.

To provide current and measurements, a mfBIA unit (ImpediVET BIS 1, Pinkenba, AU) was used, and provided a current of 1000 µA ac. Six continuous recording with an interval of 1 second at 256 frequencies was made over a range of 4 to 1000kHz.

The first ten horses were measured on both the left and right *gluteus medius*, afterwards only the left side was measured, as it was representative. The reading was repeated if the measurement was not clear.

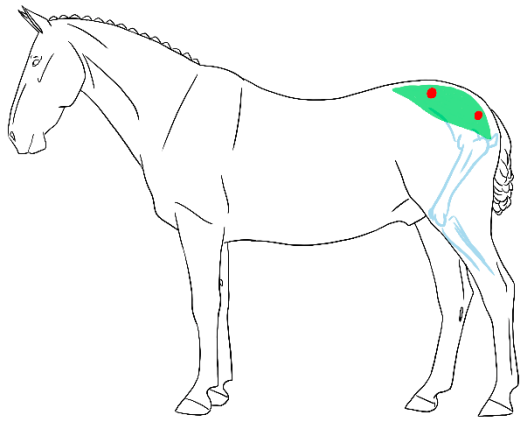


Figure 3.1: showing, marked with red dots, the placement of the paste and electrodes.

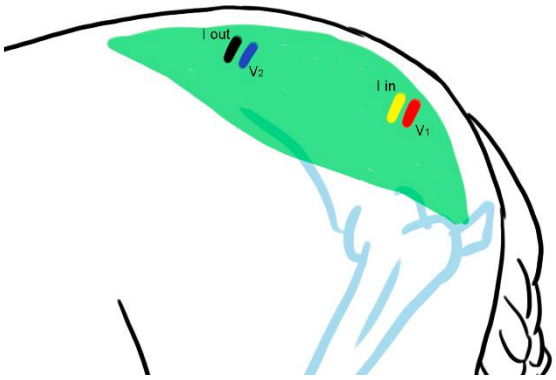


Figure 3.2: Placement of the electrodes on the gluteus medius.

3.3 Testing for hypermobility – Acoustic Myography (AMG) based on whole body assessment

Forty out of the 48 horses were used for measuring. Acoustic gel (Ekkomarine Medico A/S, Holstebro, Denmark) was applied on the horse. A sensor from the AMG unit (CURO-

Diagnostics Aps, Bagsværd, Denmark) was placed on the left *gluteus medius*, see figure 3.3, without putting too much pressure on the sensor. Adhesive tape (Snøgg AS. Kristiansand, Norway) was placed on the sensor to keep it in place.

The sensor was connected to the CURO device through a cord, and the CURO was connected via Bluetooth to the app; CURO Equine 2.2.3 (CURO-Diagnostics ApS, Bagsværd. Denmark) on an iPhone 13 mini software version 15.4.1 (Apple Inc, California, USA). Measurements at four different frequencies, 21-, 24-, 27- and 32-dB gain, were made with a measurement length of at least 10 seconds where the horse did not move and was standing on both hindlegs.

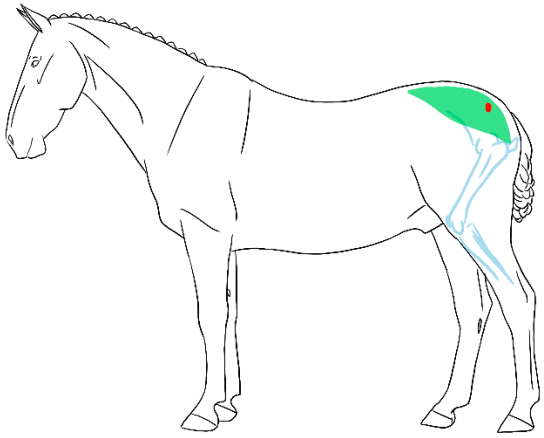


Figure 3.3: Placement of the AMG sensor (red dot) on the gluteus medius.

3.4 Data collection from physiotherapist

Four physiotherapists participated in the study by collecting data on their patients, three of them also took part in the test where their assessments on hypermobility were tested. The physiotherapists were instructed to do a hypermobility test on the horses they encountered during their work and fill out a form with information. The form included the horses' name (to make sure no horse was represented more than once), their assessment of the horses' hypermobility state, which joints the horses were hypermobile in, gender, age, breed, height, discipline, and reason for the physiotherapist to visit. The results can be seen in appendix 1. Data on 226 horses were collected.

4. Results

The results from the study can be seen in the following sections.

4.1 Test of the physiotherapists

The test by the physiotherapist showed that they on average assessed 56 % of the horses in agreement with our mfBIA results, see diagram 4.1. The results also shows that the physiotherapist had a span of 17-75% agreement between themselves as seen in diagram 4.2. Both agreement in the horse being hypermobile and not being hypermobile were accounted for.

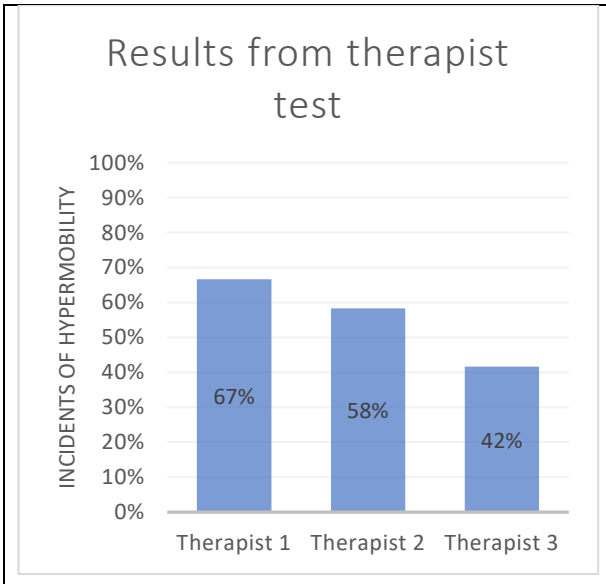


Diagram 4.1: Percentage of answers (n=12) from the physiotherapists in agreement with the mfBIA results in assessing hypermobility in horses.

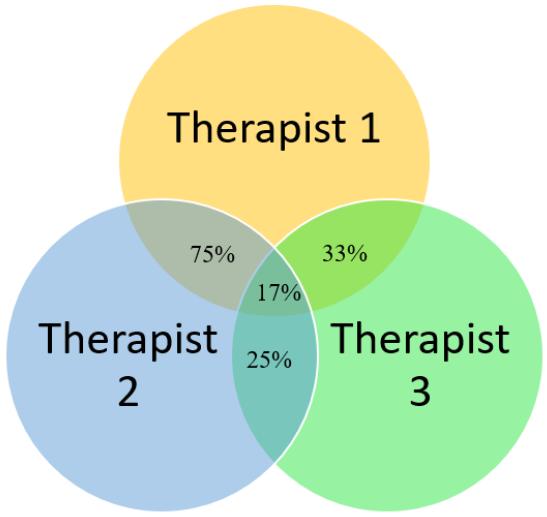


Diagram 4.2: Venn-diagram showing the percentage agreement between the three physiotherapists.

4.2 mfBIA and AMG data collection

The results from the mfBIA and AMG tests were written into Excel (Microsoft Corporation, Redmond, Washington, USA), see table 4.1, with all the information gathered on the horses. Different categories were created for the purpose of finding common traits between the horses. See table 4.2. for description of the different categories. The mfBIA and AMG assessments are objective, and do not depend on experience.

An assessment on site for AMG (AMG^{aos}) were also recorded and can be seen in table 4.1. The percentage distribution of the hypermobility assessment from the three methods can

be seen in the Venn-diagram (diagram 4.3). The AMG^{aos} results are subjective, as they are dependent on the observers experience and interpretation of the fluctuations of the graph seen in real time.

The results from mfBIA show that 38% of the horses measured were assessed as being hypermobile. Data from mfBIA were collected for 48 horses, and their membrane capacity (Mc) and intracellular resistance (Ri) were assessed and compared to a 'normal' baseline established beforehand, using data from other mfBIA measurements in horses done by A. P. Harrison. For Mc, the normal value would be around 40.4, while the value for hypermobile horses should be around 28 or lower, based on the mean from measurements done by A. P. Harrison in other studies. For Ri, the normal value is around 67.5, and for a hypermobile horse it should be around 105.6 or higher. Horses with a Mc $\leq$28 *and* a Ri $\geq$105.6 were assessed as hypermobile.

40 horses were measured with AMG and the data was collected and assessed using the ST mean values, S being spatial summation which is the amplitude of the signal to the muscle, and T being temporal summation, which is the frequency of the muscle fiber recruitment (Vitger, et al., 2021), ST is the mean of S and T. A mean based on the data was created, giving a base line for 'normal' or non-hypermobile values. A 10% higher and lower value was added to the baseline, creating an area of borderline values. Horses with a ST mean lower than the 10% lower value were assessed as hypermobile. Horses above the 10% higher values were assessed as being non-hypermobile, and horses with values in between were assessed as borderline, see graph 4.1. Of the horses in the study 35% were assessed as being hypermobile using the ST mean values and 43% were assessed as being hypermobile using AMG^{aos}.

There was a 5% agreement between the three different methods, and 5% between mfBIA and AMG, 18% between AMG and AMG^{aos} and 13% between mfBIA and AMG^{aos}, as can be seen in diagram 4.3.

	mfBIA	AMG	AMG assessment on site	Gender	Age, years	Breed	Type	Height	Discipline
1	Yes		-	Gelding	5	OLDB	WB		Dressage
2	Yes	No	No	Gelding	7	DV	WB		Dressage
3	Yes	No	No	Gelding	6	HANN	WB		Dressage
4	No	Borderline	?	Stallion	5	KWPN	WB		Dressage
5	No		-	Gelding	7	WESTF	WB		Dressage
6	No	Yes	Yes	Gelding	8	WESTF	WB		Dressage
7	Yes	No	Yes	Gelding	4	DV	WB	165	Dressage
8	Yes	No	Yes	Gelding	5	HANN	WB		Dressage
9	Yes		-	Gelding	5	WESTF	WB		Dressage
10	Borderline	Borderline	No	Mare	4	OLDB	WB	180	Dressage
11	No	Yes	Yes	Gelding	5	HANN	WB		Dressage
12	No	Yes	Yes	Gelding	7	HANN	WB		Dressage
13	No			Gelding	11	Arab	Pure	154	All round
14	No			Mare	17	DSP	Pony	156	All round
15	No			Gelding	11	OLDB	WB	161	All round

16	Yes			Gelding	8	Knap/welsh	Mix	142	All round
17	No			Gelding	12	Quarter/TB	Mix	160	All round
18	No	No	No	Gelding	11	DV	WB	165	Dressage
19	No	No	No	Gelding	27	Pony	Pony	145	Riding School
20	No	Yes	No	Gelding	20	DV	WB	160	Riding School
21	No	Yes	No	Gelding	10	Pony	Pony	140	Riding School
22	No	Yes	No	Gelding	25	DV	WB		Riding School
23	No	Yes	No	Gelding	27	Pony	Pony	145	Riding School
24	No	Yes	Maybe	Mare	-	DV	WB	165	Dressage
25	Yes	Yes	Yes	Mare	10	DV	WB	160	Dressage
26	No	Yes	No	Mare	0,4	Fjord horse	Pony		Riding School
27	Yes	Border-line	No	Mare	-	Fjord horse	Pony	145	Riding School
28	No	Yes	No	Gelding	29	Shetlands Pony	Pony	120	Riding School
29	Yes	Yes	Maybe	Gelding	12	Pony	Pony	130	Riding School
30	No	Yes	No	Mare	15	Pony	Pony	135	Riding School
31	No	No	No	Stallion	5	PRE	Ib	165	Dressage
32	Yes	No	No	Gelding	7	PRE	Ib	165	Dressage
33	Yes	No	No	Mare	6	PRE	Ib	164	Breeding
34	Yes	No	No	Mare	5	PRE	Ib	167	Breeding
35	Yes	No	No	Stallion	1	PRE	Ib	130	Dressage
36	No	No	Yes	Stallion	1	PRE	Ib	135	Dressage
37	No	No	No	Gelding	4	OLDB	WB	170	Dressage
38	Yes	No	No	Gelding	5	OLDB	WB	170	Dressage
39	No	No	Yes	Gelding	5	OLDB	WB	170	Dressage
40	No	No	No	Gelding	6	OLDB	WB	180	Dressage
41	No	No	No	Gelding	5	KWPN	WB	167	Dressage
42	Yes	No	No	Gelding	10	KWPN	WB	165	Dressage
43	Yes	No	No	Gelding	9	OLDB	WB	180	Dressage
44	Yes	No	No	Gelding	13	DV	WB	170	Dressage
45	No	No	Yes	Gelding	6	OLDB	WB	170	Dressage
46	No	No	No	Gelding	4	OLDB	WB	165	Dressage
47	No	Yes	Yes	Gelding	4	OLDB	WB	165	Dressage
48	No	No	No	Gelding	5	OLDB	WB	170	Dressage

Table 4.1: Results from the mfBIA and AMG test. (OLDB = oldenburger, DV = Danish warm-blood, HANN = Hanoverian horse, KWPN = Dutch warmblood, WESTF = westphalian horse, DSP = Danish sports pony, Knap/welsh = knapstrupper and welsh pony cross, Quarter/TH = quarter horse and thorough breed cross, PRE = Pura Raza Espanola)

Type	Different types of horse breeds are placed in
WB	Warmblood breeds, typically used for sports
Pure	Arabians and berbers, old breeds that are mostly pure
Pony	Fully grown horses under 1,48 m of the pony type and pony breeds.
Mix	Horses of mixed breeds
Ib	Iberian horses, breeds from the Iberian Peninsula
CB	Cold blood horses and breeds, often draft horses, and horses with a heavier built
SP	Sports pony, pony types and breeds bred especially for competitions like military, dressage and show jumping
Other	Other types and breeds that cannot be placed in the other categories, like pinto or quarter horse.

Table 4.2: Description of the traits used to categorize the horses in this report.

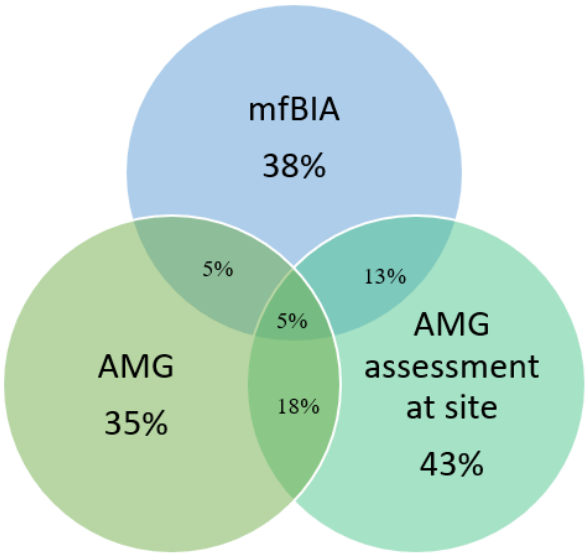
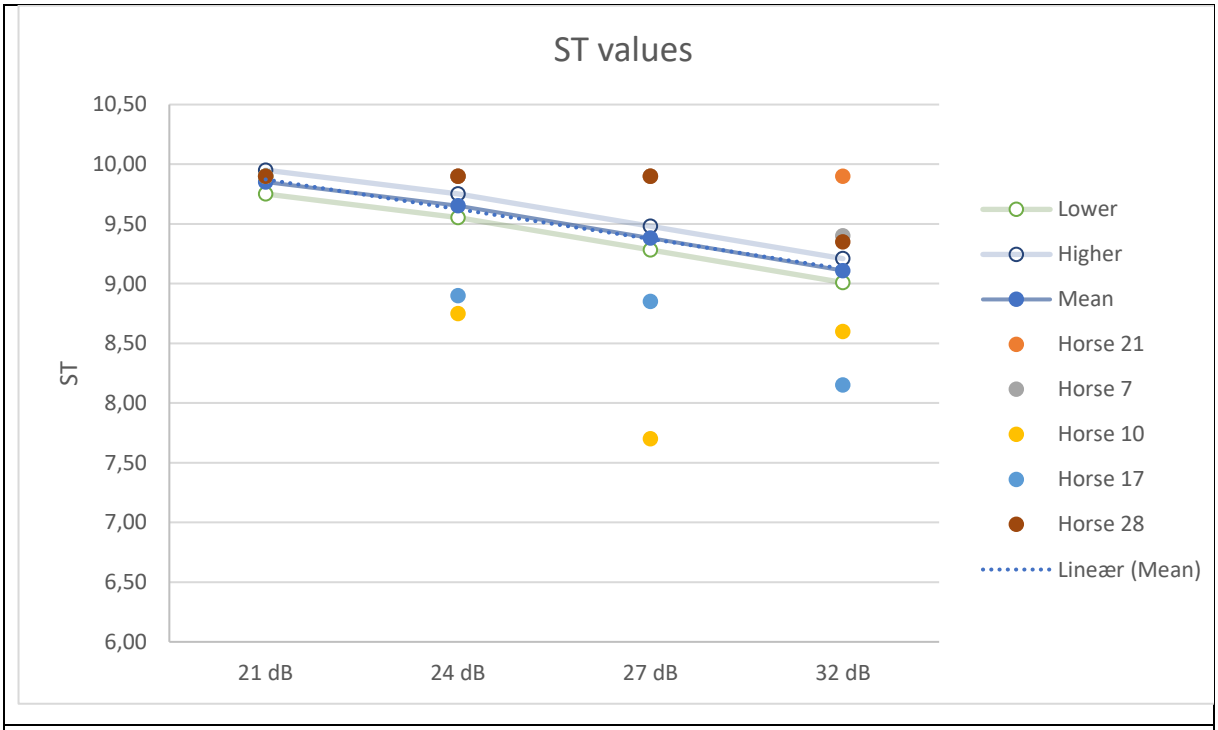


Diagram 4.3: Venn-diagram showing the overlap of hypermobile assessed horses between mfBIA, AMG and AMG assessment on site measurements (AMG^{aos}).



Graph 4.1: ST values from the AMG readings, showing the mean, a selection of the horses (n=5), and a 10% higher and lower line.

4.3 Data from the physiotherapists

Data from 226 horses were collected by the physiotherapists, these included many different breeds, ages, heights, disciplines and both geldings, mares, and stallions. The hypermobility assessment was divided into 4 categories: 'whole body' hypermobile, 'local' hypermobile, non-hypermobile and 'could not assess'.

To qualify as being assessed as ‘whole body’ hypermobile, the hypermobility in the joint must not be restricted to one area. The back and forehand/hindquarters must be assessed as being hypermobile for the horse to be qualified as ‘whole body’ hypermobile. If not, the horse is qualified as being ‘local’ hypermobile. The full data set can be seen in appendix 1.

4.3.1 Breed and type distribution

The results from the physiotherapists’ data collection show a tendency of assessed hypermobility in 56% of the horses, 33% were assessed as being ‘whole’ body hypermobile and 23% were assessed as being ‘local’ hypermobile, as seen in diagram 4.4. In the data collected 34% of the horses were assessed as being non-hypermobile and 10% could not be assessed by the physiotherapists.

The ‘whole body’ hypermobile assessed horses were categorized into types, see table 4.2, depending on their breed, only types with n=20 or more were analyzed further. The type: Icelandic, Warmblood and Pony had n=20 or more. The results show that of the Icelandic horses visited by physiotherapists, 54% were assessed as being ‘whole body’ hypermobile, for warmblood this was 30% and 7% for ponies. The Icelandic horse and the warmbloods were looked at, for further analysis. The ponies were assessed as having to big of a difference in breeds, to be a truly representative type for this analysis.

For the Icelandic horses (n=57) 7% were assessed as being non-hypermobile, while 32% were ‘local’, 7% could not be assessed and 54% were ‘whole body’ hypermobile.

In the warmblood type (n=96) 44% were assessed as being non-hypermobile, 17% as being ‘local’ hypermobile, 8% could not be assessed and 30% as being ‘whole body’ hypermobile.

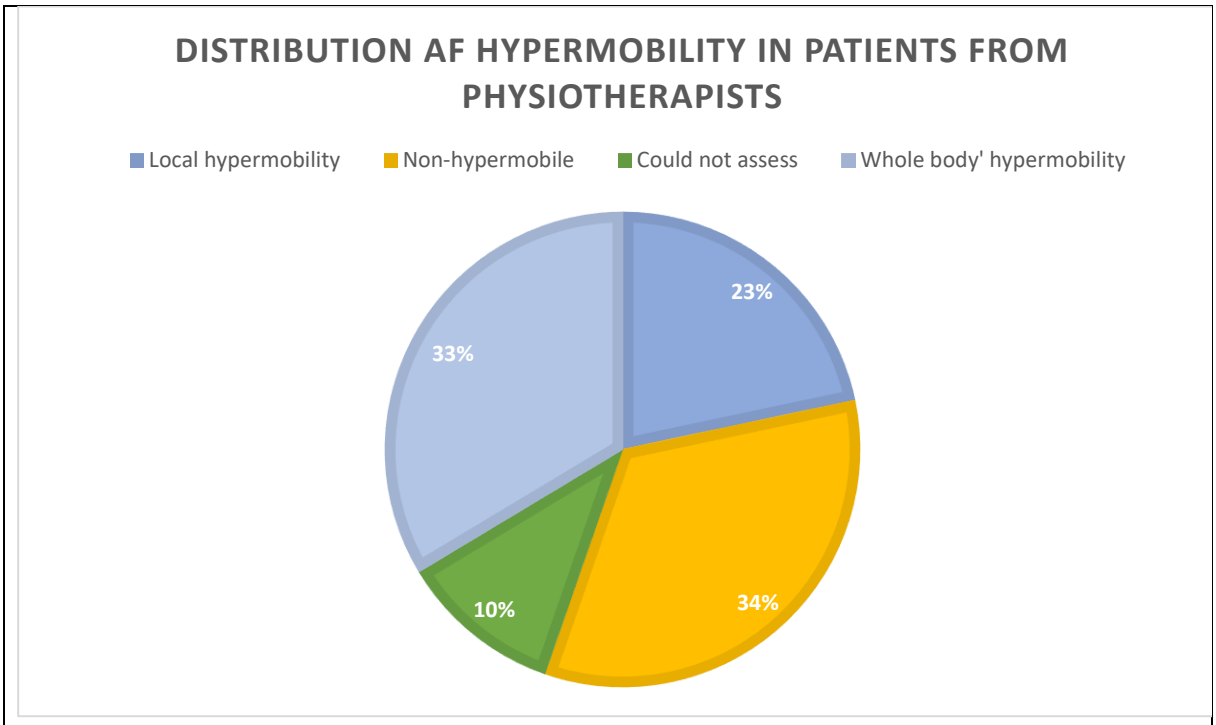


Diagram 4.1: Distribution of horses with and without hypermobility based on 226 horses visited by a physiotherapist. 'Local hypermobility' is local hypermobility assessed in joint, and ''Whole body' hypermobility' is hypermobility assessed in at least the back and forehand or hindquarters.

4.3.2 Treatment reason

The reason for the physiotherapists to treat the horses has been divided into four groups: injury or disease, general problems, checkup and unknown. These reasons are not dependent on what the physiotherapists assessed during their visit and are entirely based on the owners' reason for wanting the physiotherapists to examine the horse in the first place. The results can be seen in table 4.3.

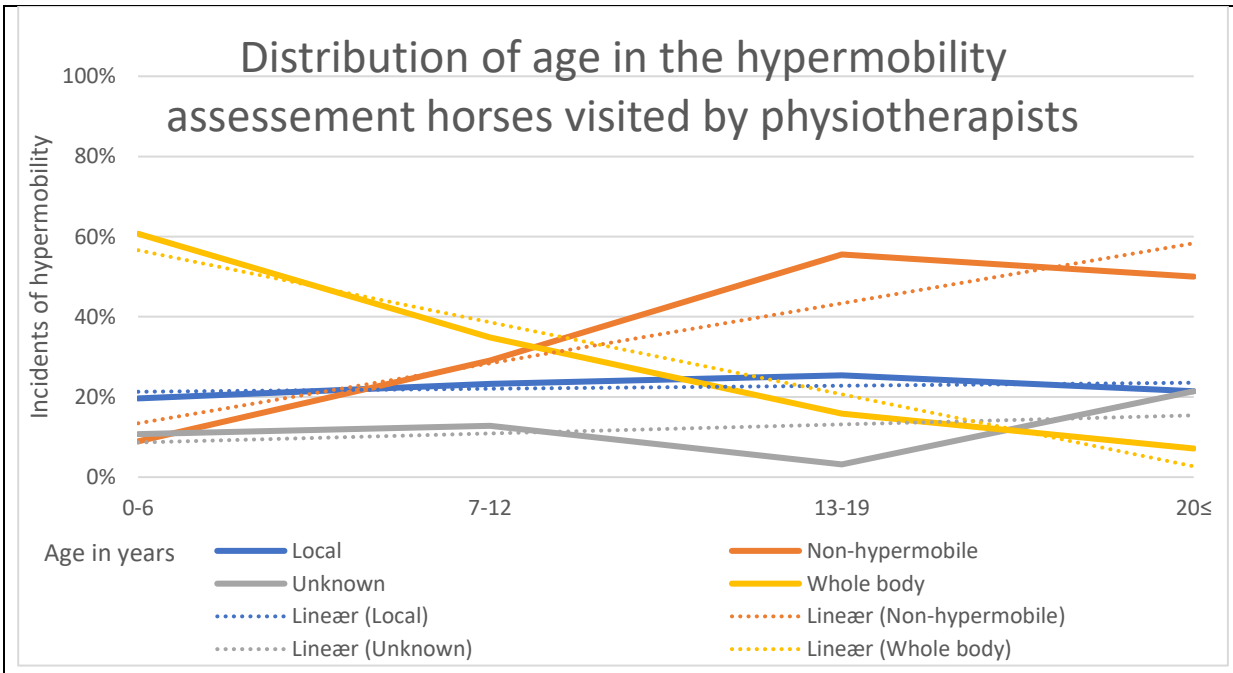
Hypermobility assessment on the visit	**Injury or disease**	**General problems**	**Checkup**	**Unknown**
	Lameness, injury, arthritis	Behavioral problems, general problems, physical problems not caused by a known illness or injury	Owner wants the horse to be checked, no physical or behavioral problem known before the visit	No reason given
Horses assessed as non-hypermobile	36%	37%	22%	9%

Horses assessed as 'whole body' hypermobile	36%	49%	19%	0%
Horses assessed as 'local' hypermobile	33%	42%	27%	2%

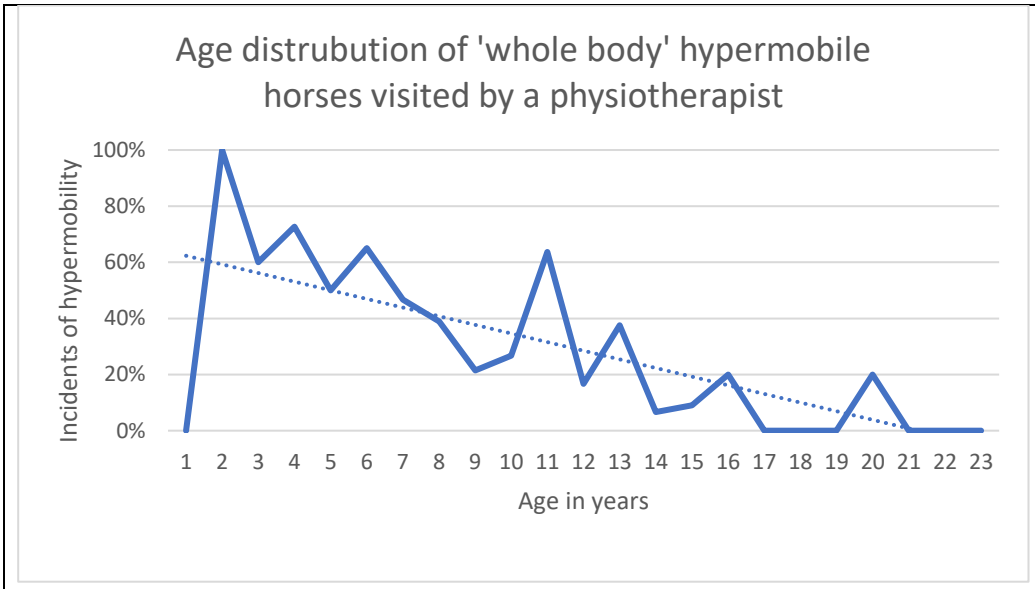
Table 4.3: The percentage distribution of the reason for the visit or treatment from the physiotherapist.

4.3.3 Age distribution

The data seen in appendix 1 was sorted by age, and divided into 4 categories: 0-6, 7-12, 13-19 and 20≤. The results can be seen in graph 4.2 and 4.3 where the percentage distribution is shown.



Graph 4.2: Age distribution of the hypermobility assessed horses done by the physiotherapists. Lineær = linear tendency line.



Graph: 4.3: The age distribution of 'whole body' hypermobile assessed horses.

4.3.4 Usage or discipline distributions

The usage or discipline of the horses from the data collected by the physiotherapists, seen in appendix 1, were sorted and broken into seven different categories. Categories with less than 10 horses were placed in the category 'Other', as seen in table 4.4 and will not be looked further at in this report.

In the All-round category, the horses had an average height of 149.4 cm, and an average age of 11.3 years. The Icelandic horses were the most common breed with 11 horses, and only two horses (one Icelandic horses and one DW) were assessed as being 'whole body' hypermobile.

For dressage, the average height was 165.0 cm, and average age was 9.6 years. DW was the most common breed in this discipline with 56 horses (67%), and 41% of them were assessed as being 'whole body' hypermobile. Three out of five of the DSP (Danish sports pony) were assessed as being 'whole body' hypermobile as well. The rest of the breeds were only represented by four or less horses and will therefore not be analyzed further.

In the jumping category, 7% were assessed as 'whole body' hypermobile, and 36 % as local hypermobile. The average height and age were 155.7 cm and 12.2 years. The most used breeds were DW and DSP, none of which were assessed as being 'whole body' hypermobile.

The Icelandic riding discipline consists of the owners answering oval training, gait riding, Icelandic riding, or Icelandic competition, and in the category, only Icelandic horses were represented. The age and height averages were 8.5 years and 140.9 cm. All but two horses were assessed as being 'whole body' hypermobile (87%), and 80% of the horses in this category had

'problems with riding' as a reason for seeing a physiotherapist, compared with 43 % (jumping), 49% (dressage), 53% (all round), 40% (breaking in), 21% (trail) and 14 % (others).

For trail, the average height and age were 144.0 cm and 13.5 years. For the Icelandic horses (69%, n=20) in this category, 8 (40%) of them were assessed as being 'whole body' hypermobile. 20% of the Icelandic horses in this category had 'problems with riding' as reason for the physiotherapist to visit.

Breaking in, is a category for horses that has just started to be ridden, their height and age was 151.7 cm and 4.5 years on average, one horse was 8 years old. 60% were assessed as being 'whole body' hypermobile, and 67% of these horses had 'problem with riding' as reason for visit. No breed was represented with more than 3 horses.

		Total	Hyper-mobile	Local hy-permobile	Non-hyper-mobile	Un-known	Whole body	Problem with rid-ing as reason for physio visit
All-round		38	15	13	20	3	2	
			43%	35%	50%	8%	8%	53%
Dressage		84	48	15	29	7	33	
			57%	18%	35%	8%	39%	49%
Jumping		14	6	5	4	4	1	
			43%	36%	29%	29%	7%	43%
Icelandic rid-ing		15	13	1	0	1	13	
			87%	7%	0%	7%	87%	80%
Other		36	15	4	15	6	11	
			42%	11%	42%	17%	31%	14%
Trail		29	19	10	8	2	9	
			66%	34%	28%	7%	31%	21%
Breaking in		10	9	3	0	1	6	
			90%	30%	0%	10%	60%	40%

Table 4.5: The distribution of the hypermobility assessment in the different equine usages and disciplines. 'Other' consist of young horses, unknown, trail and therapy, therapy, retired, not ridden, military, leisure, hunting, ground training, distance, company, child's horse, and driving. 'Icelandic riding' includes oval track, gait riding and Icelandic competition.

4.3.5 Gender

The gender distribution of the horses was 100 mares, 120 geldings and 6 stallions. Of these 31% of the mares, 33% of the geldings, and 67% of the stallions were assessed as being 'whole body' hypermobile, as can be seen in diagram 4.5. Mares had a higher percentage (27%) of being assessed as 'local' hypermobile compared to geldings (20%) and stallions (17%).

Stallions were found to be assessed as ‘whole body’ hypermobile in 67% cases and non-hypermobile in 0% of the horses but were also the smallest group (n=6).

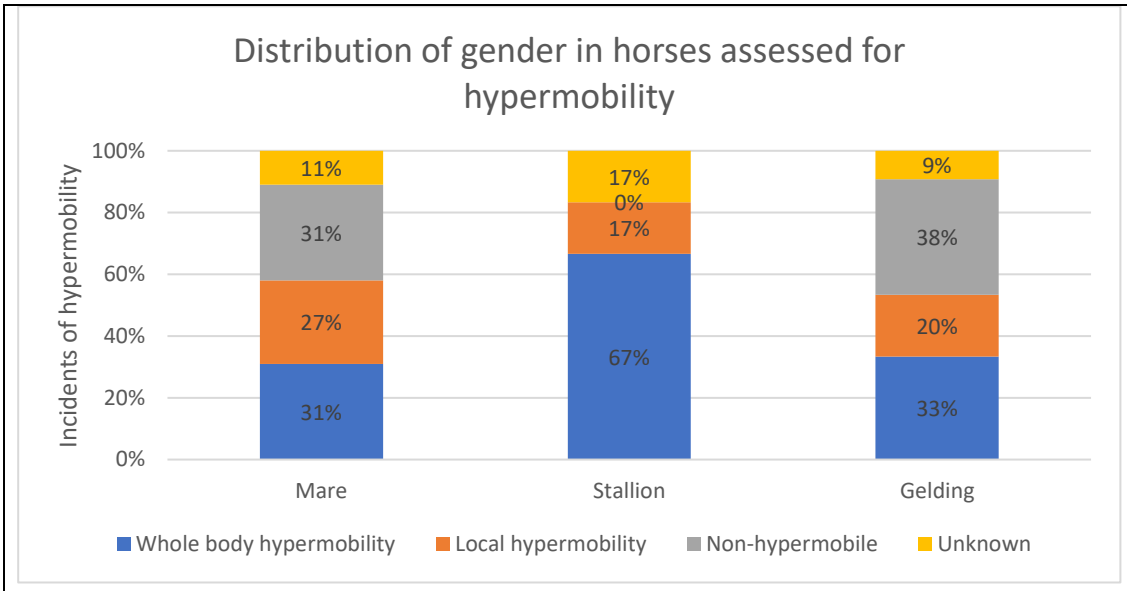


Diagram 4.5: Percentage distribution of a hypermobile assessment done by physiotherapists, grouped by gender: mare, stallion, and gelding.

4.3.6 Height

The height as a factor (n=225) was looked at from the data collected from the physiotherapists, and divided into different intervals, see graph 4.4. The results show a tendency for an increase in ‘whole body’ hypermobility with increased height. For both ‘local’ hypermobility and non-hypermobile there may be a tendency to a decrease when height increases. There is a drop in ‘whole body’ hypermobile assessed horses in the height interval 150-159 cm, see table 4.4., in the same interval (150-159 cm) there is an increase in horses that could not be assessed. The highest percentage of non-hypermobile horses was found in the interval 160-169 cm. The interval 180-189 cm had a 100% of ‘whole body’ hypermobility, but the interval only consisted of 2 horses, therefore this will not be commented further in this report.

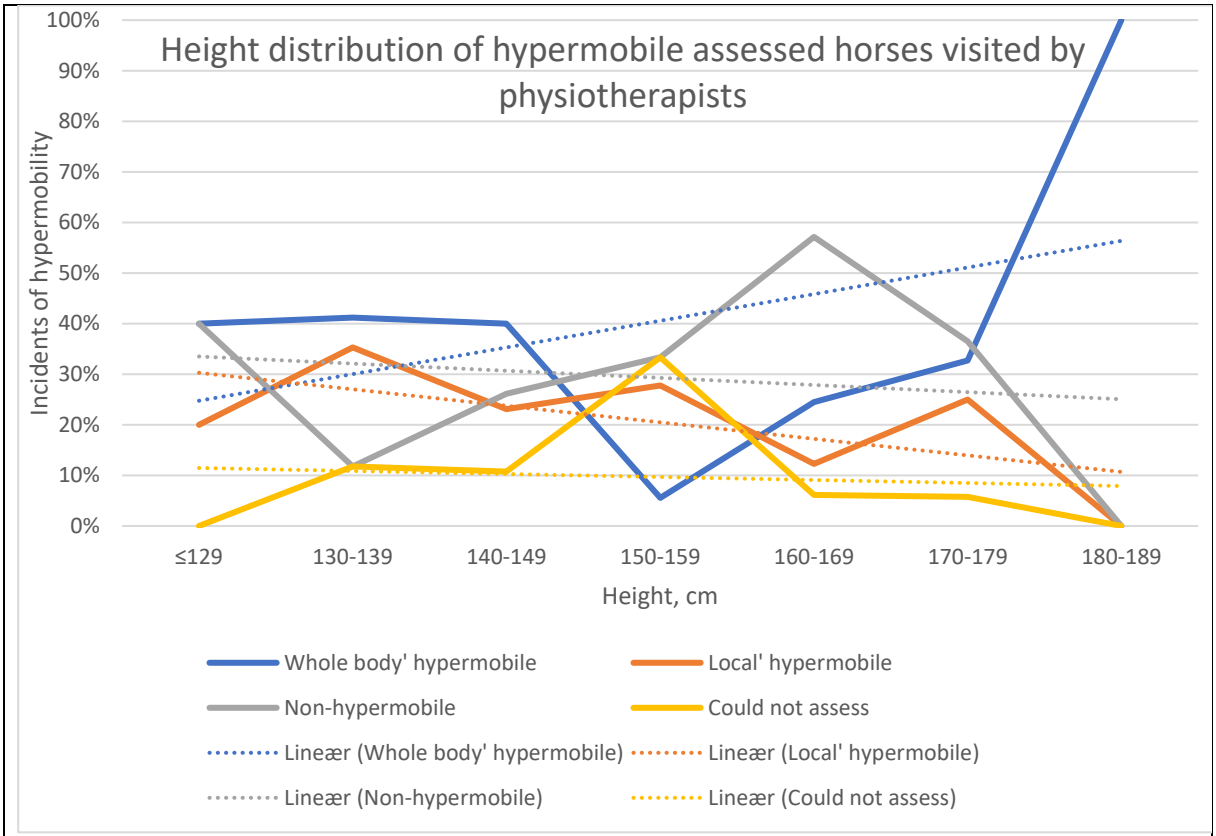


Table 4.7: The height distribution of horses assessed for hypermobility by physiotherapists, and tendency lines (lineær). ≤129 (n=5), 130-139 (n=34), 140-149 (n=65), 150-159 (n=18), 160-169 (n=49). 170-179 (n=52), 180-189 (n=2). Lineær = linear tendency line.

5. Analysis and discussion

To better understand the results from the study, the data was analyzed and discussed in the following section of this report.

5.1 Test of the physiotherapists

The physiotherapists' assessment of hypermobility is subjective and is difficult to compare to the mfBIA assessments. The findings of this study show that there is 42-67% agreement between the physiotherapists and mfBIA, and only 17% overall agreement between the physiotherapists themselves. This highlights the subjectiveness of the physiotherapists' assessments, and the need for an improved guideline. The physiotherapists did not palpate the whole body of the horse during the test, therefore an assessment between 'whole body' and 'local' hypermobility could not be done. Some of the horses assessed as being hypermobile by the physiotherapists but not by mfBIA could be 'local' hypermobile.

Furthermore, the physiotherapists are palpating the joints of the horse and assessing the angle of flexion or extension based on their education and experience, basing hypermobility on the joints ability to bend. Natural occurring hypermobility ('whole body') is defined by this study, as change in the ligaments in such a way, that they are not able to support and stabilize the joints, requiring the muscles to take over the stabilizing function. The muscle activity can be measured by mfBIA, allowing the measurement to not include 'local' hypermobility, where only the range of motion in the joint is affected and not the muscle. This is an important factor to consider when comparing the two methods and trying to define hypermobility.

5.2 mfBIA and AMG data collection

There is little agreement between the mfBIA, AMG and AMG^{aos} data, showing that the different techniques can be difficult to compare as there are many variables that can affect the results. Comparing mfBIA with AMG is comparing the cells' capability at cellular level to pass an electric current with the acoustic properties of the whole muscle. With the standards set by this report to assess hypermobility, the two methods agree 5% of the time. This could be an indication of true hypermobility, but it could also mean that adjustments to the methods needs to be done. The muscle *gluteus medius* may not be a suitable muscle for measuring hypermobility depending on muscle activity, as this is not a stabilizing muscle for the skeleton system, but rather a muscle used for creating power and pushing the horse's body forward. Our findings may show that *gluteus medius* is in fact not suitable for hypermobility assessment.

When comparing the AMG data with the AMG^{aos} data, it is seen that the measurements are in agreement only 18% of the time. This could be caused by the AMG measurements not having the data sorted for fluctuations caused by a small muscle adjustment made by the horse. This will pull the ST mean down. The horses 18-30 in table 1 were not used to being in the stable at the time of the visit, as they were used to being outside in the fields. There was a lot of activity in the stable, and the horses may have been eager to get outside, tensing their *gluteus medius* in anticipation to start walking. This will create fluctuations and may decrease the ST mean to a point where the horse looks hypermobile. The subjective assessment made by the AMG^{aos} measurements accommodates for this, as the fluctuations are seen on the graph produced by the CURO Equine app in real time.

Because of the lack of agreement between the different methods, and possibility of *gluteus medius* not being the right muscle to assess hypermobility, the results will not be analyzed further, and will therefore not be used for statistics.

5.3 Data from the physiotherapists

The data collected from the physiotherapists consisted of 226 horses, where 33% were assessed as being 'whole body' hypermobile. When compared to hypermobility in the human population of 10-30% (McCormack, et al., 2004), and to the results from mfBIA and AMG that had an overlap of 5%, hypermobile horses may be overrepresented as physiotherapist patients. Hypermobility can be difficult to diagnose, with the occurrence of few or no symptoms and the effect that aging has, as it is more common in children than adults (Hakim & Grahame, 2003), and the assessment of the physiotherapists is subjective as shown in this study.

Information from the physiotherapists' data can however be useful, and the data from factors were analyzed, to give further information and understanding about hypermobility.

5.3.1 Breed and type

Icelandic and warmblood horses may have an increased risk of hypermobility, both for 'local' and 'whole body' hypermobility. Both types of horses are often bred for their gaits, whether it is for big movements, seen in dressage, or a specific movement pattern like tölt or flying pace. Icelandic horses had a percentage of 56% 'whole body' hypermobility, warmbloods had 30%, and ponies 7%, only these three groups had 20 or more horses, making the data more representable and reliable. The pony group did not include sports ponies, that, as warm bloods, are bred for competitions like dressage and showjumping, the 'pony' group therefore represents horses that may not have been bred for a specific gait. The higher prevalence of 'whole body' hypermobility in the Icelandic horse and warm blood horses may therefore be a biproduct caused by breeding goals focused on extreme movements, favoring horses with greater flexion and extension in their joints.

5.3.2 Treatment reason

Horses assessed as being 'whole body' hypermobile by the physiotherapists may have an increased risk of having problems in training (49%) (behavioral problems, general problems, physical problems not caused by a known illness or injury) compared to horses assessed as being non-hypermobile (37%). Horses assessed as being 'local' hypermobile may also have a higher risk (32%) than non-hypermobile horses, but lower than 'whole body' hypermobile horses.

The distribution of horses having illness or injury as a reason for the visit was similar in the three hypermobility assessment groups, as seen in table 4.3. 'Whole body' hypermobile horses had a checkup as the reason for the visit 19% of the time, compared to non-hypermobile (22%) and 'local' hypermobile (27%).

These results may indicate that horses assessed as being hypermobile may have a higher risk of general problems, leading to the possibility that they may need a different environment (in training, housing etc.) compared to horses not assessed as being hypermobile.

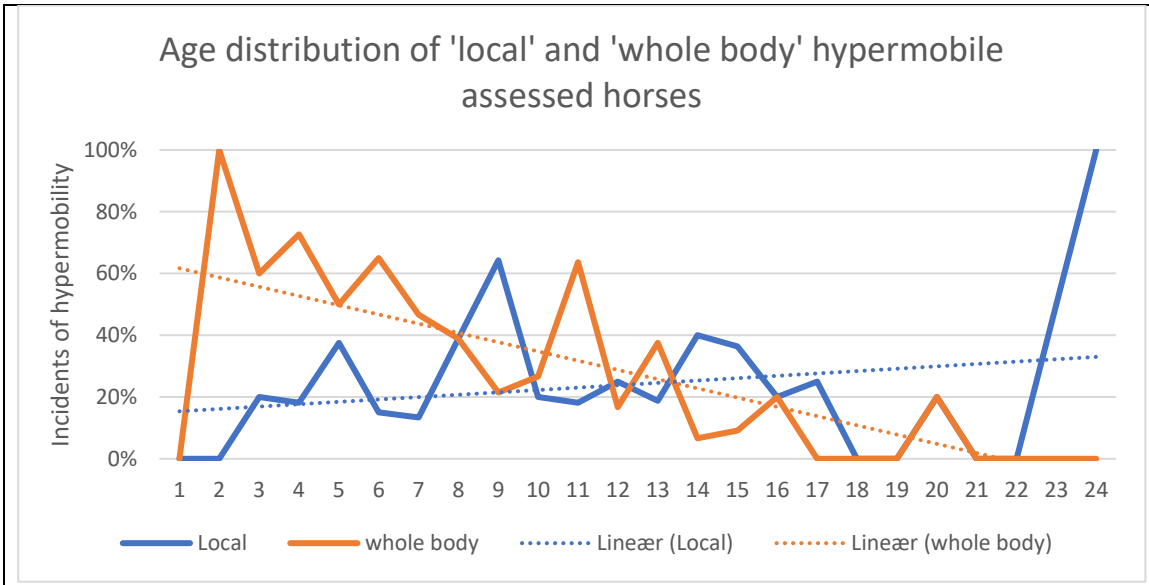
5.3.3 Age

In graph 4.2 and 4.3, 'Whole body' hypermobility seems to be declining with age. This fits with data collected from humans, where studies have shown that hypermobility declines with a higher age (Hakim & Grahame, 2003). This could indicate that naturally occurring ('whole' body) hypermobility is present and may be assessed by physiotherapists. The number of non-hypermobile assessed horses seems to increase with age, which is in compliance with the decrease seen in 'whole body' percentage.

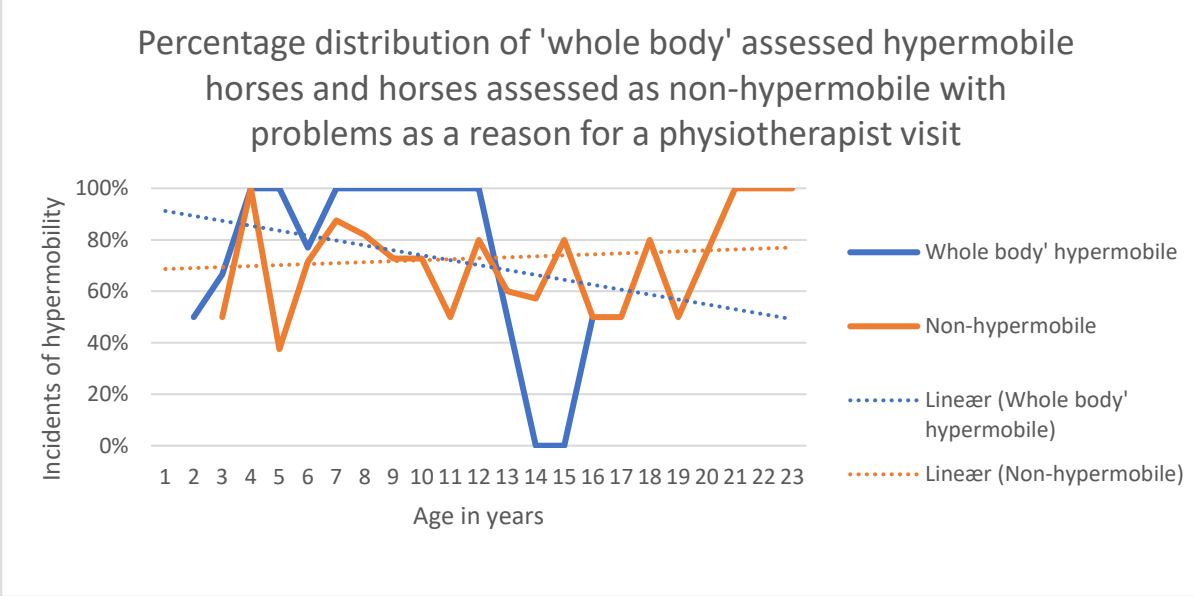
'Unknown' is slowly increased in young horses, then decreasing until the horses reach the age around 13 where it increases again. This could be due to the fact that younger horses are more difficult to assess because of their young and undeveloped skeletons, and younger horses may have a higher prevalence for hypermobility. In the mature horse (<7 years), the skeleton and joints are fully developed, making it easier to assess if the horse is hypermobile. With age, horses may get arthritis or be stiffer, which may make it harder to assess hypermobility, explaining the increase in 'unknown' seen on the graph in table 4.2.

'Local' hypermobility seems to be increasing with age, see graph 5, which may indicate that 'local' hypermobility differs from 'whole body' hypermobility, and could be an indication of forced or trained hypermobility, as it should be developed over time.

In the younger age groups, as seen in graph 5.2, the risk of having 'general problems' as reason for the physiotherapist visit was higher, with a 100% in age groups 4-5 and 6-12 years. The tendency line in graph 5.2 is declining with age, indicating that younger horses may have more problems with hypermobility than older horses that may have built up more strength and adapted. The tendency line for the non-hypermobile horses is increasing with age, indicating that this group are older before having a visit by physiotherapists because of 'general problems'.



Graph 5.1: The age distribution of horses assessed as being 'local' and 'whole body' hypermobile by physiotherapists. Linear tendency lines showing development through the ages.



Graph 5.2: The percentage distribution of 'whole body' hypermobile and non-hypermobile (as assessed by physiotherapists) with 'problems with riding' as a reason for the physiotherapist to visit. 'Problem with riding' was a subjective assessment, made by each horse owner, and could include stiffness, problem behavior (problem for the rider) and gait problems.

5.3.4 Usage

In the usage factor, Icelandic riding may be considered a risk factor for hypermobility, as 87% of the horses in this category were assessed as being 'whole body' hypermobile. Icelandic riding is often based around gaits like tölt and flying pace, which requires extreme bending of the joints. Only Icelandic horses are used in Icelandic riding and competitions. Of the horses used

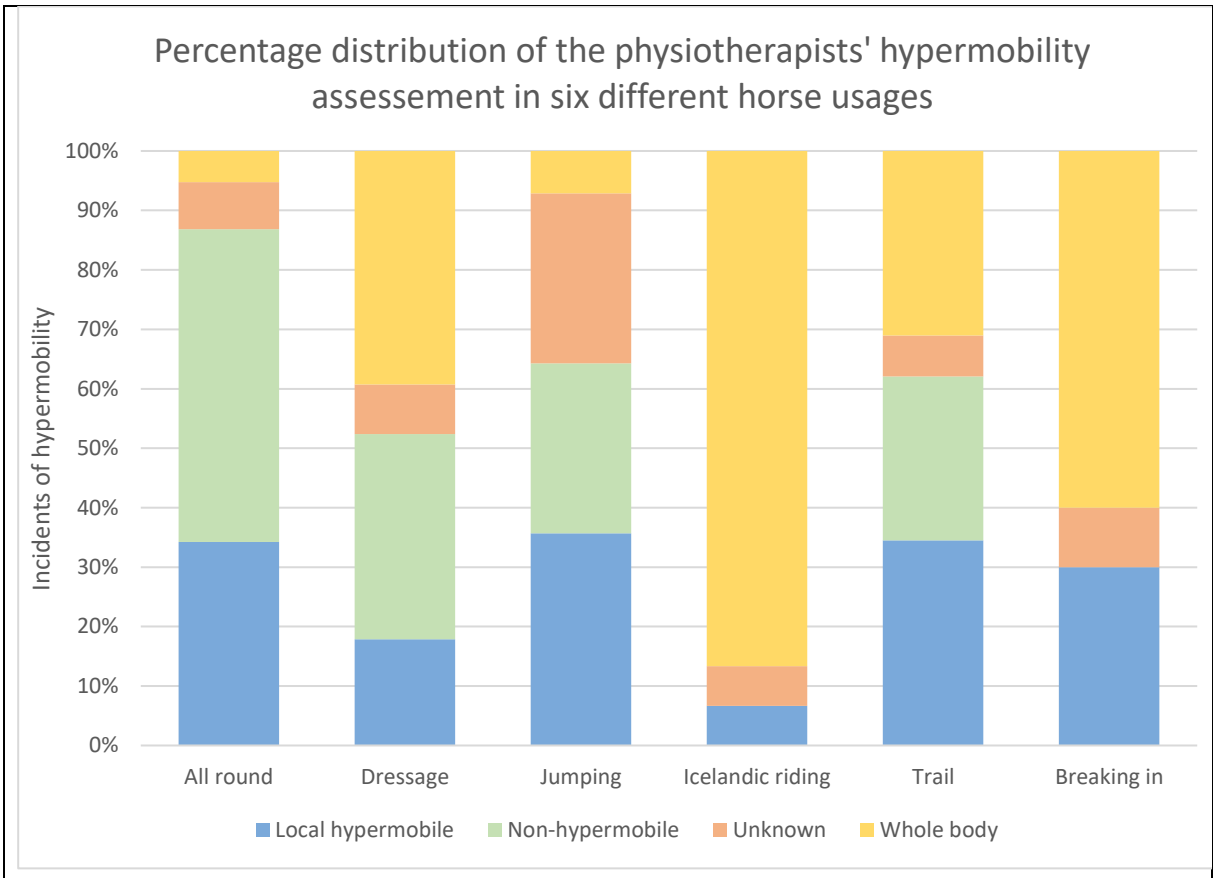


Table 5.3: Distribution (in %) of hypermobility in six different equine usages or disciplines, assessed by physiotherapists.

for trail rides 69% of them were Icelandic horses as well, this could explain the 31% 'whole body' hypermobile assessed horses in this factor, as 8 out of the 9 'whole body' hypermobile horses were Icelandic horses.

Dressage horses may also have an increased risk of being hypermobile as 39% were assessed as being 'whole body' hypermobile. This may be caused by the advantage a hypermobile horse may have in showing big gaits with extreme flexion and extension, often favored by judges in competitions.

Breaking in seem to be a risk factor for hypermobility, but as the average age in this category was 4.5 years, it may be that the age of the horse is more of a factor than the breaking

in factor. Young horses, as established by this report, may have a tendency of being at risk of hypermobility, which is also seen in human populations.

5.3.5 Gender

There seems to be an even distribution of 'whole body' hypermobile assessed horses for mares and geldings. Unknown hypermobile status is also very similar with 11% for the mares and 9% for the geldings. However there seems to be a slightly higher risk of 'local' hypermobility assessment in mares (27%) than in geldings (20%), as well as fewer mares (31%) being assessed as being non-hypermobile than geldings (38%). This could indicate that 'local' hypermobility is easier to induce in mares than geldings, perhaps through training. This lines up with studies in humans, where hypermobility is more common in the female population (Hakim & Grahame, 2003).

The results also showed that 'whole body' hypermobile assessed mares had more 'general problems' (68%) than the geldings (38%), but geldings were at higher risk of injuries or illness (43%) as a reason for the physiotherapist to visit, compared to mares (26%). A study by Klemp & Learmonth (1984) showed that male ballet dancers had an increased risk of ligaments injuries, where females had an increased risk of muscle damage. This could indicate that geldings have a stronger base than mares, and that mares assessed as being hypermobile may have an increased risk of their muscles being overworked, and thereby creating problems for horse and rider.

The results from the stallions were assessed as being too small a group and will not be commented on.

5.3.6 Height

According to the physiotherapists' assessments, hypermobility seems to be more common in horses ≤150 cm and ≥160 cm, however, this may be caused by Icelandic horses often being under 150 cm and warmblood horses often being over 160 cm in height, as these two types may have an increased risk of being hypermobile. These two types of horses are overrepresented in the data and can therefore influence the height results. Horses from other types in the heights ≤150 cm and ≥160 cm did not show a tendency to be hypermobile.

5.4 Sum up and semi-conclusion

Looking at the data, there seems to be some tendencies. In table 5.1, it is shown that there may be a tendency of 'whole body' hypermobility in warmblood and dressage horses, as these two factors put together are representing 33% of the entire 'whole body' hypermobile group. Of the

‘whole body’ hypermobile warmblood horses 86% were used for dressage, and 76% of the ‘whole body’ hypermobile dressage horses were warmbloods, showing that there may be a connection between these two factors.

The Icelandic horses had the highest occurrence of ‘whole body’ hypermobility and 87% of the Icelandic horses used for Icelandic riding were assessed as being ‘whole body’ hypermobile, indicating an increased occurrence.

Horses assessed as being ‘whole body’ hypermobile were often younger horses and a tendency was seen of general problems as the reason for the physiotherapists to visit. The gender distribution was quite even, disregarding stallions, but mares seemed to have an increased risk of ‘local’ hypermobility and general problems, where geldings had an increased risk of injuries.

Overall, there seems to be some tendencies in horses assessed as being ‘whole body’ hypermobile. The ability to flex and extend out of the range considered as normal by the physiotherapists, may have an impact on the horses’ welfare. This data is based on the assessments from physiotherapists, and whether this is truly naturally occurring hypermobility is still unknown.

Warmblood horses + dressage	n=25	33% of the ‘whole body’ hypermobile group (n=75)
Warmblood horses (33% ‘whole body’ hypermobile out of 226)	n=29	25/29*100 = 86% of the ‘whole body’ hypermobile warmblood horses were used for dressage
Dressage (57% ‘whole body’ hypermobile out of 226)	n=33	25/33*100 = 76% of the ‘whole body’ hypermobile dressage horses were warmbloods.

Table 5.1: Connection between the factors warmblood horse and dressage.

5.4.1 Can this data be used as general statistic for the Danish horse population

Because of the lack of data and information on equine hypermobility, there are a lot of factors that needs to be accounted for. One out of four of the horses visited by a physiotherapist were Icelandic, and they constituted 43% of the hypermobile horses. This could push the data to show a higher percentage of hypermobile horses.

There is also the factor of the owners. Owners of some type of horses, like Icelandic horses or warmblood dressage horses, may be more inclined to call a physiotherapist than others, such as the Arabian horse owner or trail rider. The data from the physiotherapists does not

represent the general statistic in Denmark, as the data is relying on the owners scheduling a physiotherapist visit. As only 22% of the horses had 'checkup' as the reason for the visit, it can be assumed that most of the horses had problems, illnesses, or injuries. Therefore, this data cannot be used as an overall statistic across the Danish horse population.

It can however be used to assess if hypermobile horses may be overrepresented in horses experiencing various problems, and thereby may have an increased risk for problems, illness, or injury. For this to be reliable data, the same type of objective measurements needs to be used, as the palpation of the physiotherapists themselves seems to be too subjective.

5.4.2 Is hypermobility overrepresented at physiotherapists visits?

Whether hypermobile horses are overrepresented in the physiotherapist data is still unclear, as it is difficult to compare the subjective assessment from a physiotherapist with the objective measurements done by mfBIA and AMG. Furthermore, the physiotherapists' assessment is done by an individual palpation of the joints, where mfBIA and AMG are measuring muscle activity. The mfBIA and AMG findings of this study indicate that measuring the *gluteus medius* may not give valid data on hypermobility, as there was only 5% agreement between the two methods, making it even harder to compare with the physiotherapists' data.

The data from the physiotherapists assess that 33% of the horses were 'whole body' hypermobile, this is not far from the data on human population (10-30%). Most of the horses assessed as being 'whole body' hypermobile were warmblood horses and Icelandic horses. As most of the horses visited by physiotherapists were from these two groups, the percentage of 'whole body' hypermobile horses may have been increased, indicating that there may be an overrepresentation of 'whole body' hypermobile horses in the physiotherapists' data. This could be caused by warmblood and Icelandic horse owners using physiotherapists more than owners of other breeds. But looking at the data where 49% of the 'whole body' hypermobile horses were having general problems compared to 37% for the non-hypermobile assessed horses, is seems likely that hypermobility is a risk factor. Data from mfBIA and AMG could not be used to validate these findings.

5.4.3 Can AMG and mfBIA be used as reliable measurement methods?

The mfBIA and AMG data did not show consistent agreement in this study, showing that corrections may need to be implemented. Some type of horses or ways of use should, in theory, be at a higher risk of having hypermobile horses. For the AMG data, the results show that most of the horses assessed as being hypermobile were riding school horses. This is surprising, as hypermobility would be expected to be a disadvantage, and a hypermobile horse

would therefore, in theory, not be likely to last as a riding school horse. AMG is measuring the *gluteus medius'* muscle activity, which means that small tensions caused by stress, eagerness to move or the horse simply being impatient, could cause readings in the same range as would be expected for a hypermobile horse. AMG should therefore be used on different muscles, standing still, walking, trotting, and cantering, thereby creating a more valid baseline to follow, as a hypermobile horse should have a lower ST mean when working, than a non-hypermobile horse.

mfBIA may have been a the most reliable method in this report. Horses assessed as being hypermobile by mfBIA were mostly dressage horses of the warmblood type, as would be expected, but this method is highly reliant on the horses having at least 24 hours of rest before measuring. Twenty-four hours may, on the other hand, not be enough rest, as horses need up to 72 hours of rest for the muscles to restore. Most of the warmblood horses from the mfBIA measurements had competed prior to the visit and may not have been rested enough for the measuring to be accurate. As mfBIA is measuring the *gluteus medius* in this report, the method relies on a hypermobile horse's muscle working harder than a muscle in a non-hypermobile horse. The method cannot distinguish between an overworked muscle due to training and an overworked muscle due to hypermobility.

5.4.4 The Icelandic horse

Many (86%) of the Icelandic horses examined by the physiotherapists were assessed as being hypermobile, but 32% of these were assessed 'local' hypermobile, especially only in the legs. This does not meet the criteria set by this report, where the whole body needs to be affected. This could mean that these horses are forced hypermobile. Many (54%) of the Icelandic horses were indeed assessed as being hypermobile in the whole body, and thereby qualified as being 'whole body' hypermobile, compared to the warmblood horses where 31% were assessed as 'whole body' hypermobile, and 17 % being 'local' hypermobile.

Hypermobility seems to be assessed more often in Icelandic horses than other types of horses. Taking into consideration that 86% of the 'Icelandic riding' horses were assessed as being 'whole body' hypermobile, there could very well be a correlation between hypermobility and Icelandic horses. Icelandic riding and competition are based on tölt and flying pace, where bigger and faster movements are favorable. This could favor a hypermobile horse for breeding, and thereby preserving and maybe enhancing the trait.

The findings (32% 'local' hypermobile in Icelandic horses compared with 17% in warm blood horses) could, in theory, indicate that Icelandic horses may have a wider range of motion

in their joints, without the joints being hypermobile, making it easier to train or force the joints to become hypermobile, or make it confounding for the physiotherapists. This could also mean that just a small change in the ligaments structure in the next generation could result in hypermobility. Ideally, measurements need to be done with AMG or mfBIA, to investigate how widespread hypermobility is in Icelandic horses to test this theory. If this method does not reveal as many hypermobile Icelandic horses, it could mean that they just have a wider range of motion in their joints than other horses, without losing the ligaments' stabilizing function.

5.4.5 Warmblood horses

Warmblood horses and dressage were assessed as being a risk factor for hypermobility. If this is caused by breeding, where hypermobility is favored, there should be an increase in horses assessed as hypermobile throughout the years. There is no data to support this theory, but through communication with the physiotherapists from this study, their assessment was that there has been a clear increase in hypermobile horses throughout their years of practice. This indicates that hypermobile warmblood horses may be favored in breeding, making the trait more common, especially in dressage.

6. Conclusion

Comparing the hypermobility assessments from physiotherapists with the mfBIA measurements done on the *gluteus medius* still yields unclear results. The measurements from mfBIA were not assessed as being reliable enough to truly being comparable with the physiotherapists' assessments. The assessments from the physiotherapists may also be too subjective and individual, as there is only little agreement between them, and they are influenced by experience. Furthermore, physiotherapists may not be able to distinguish between naturally occurring ('whole body') hypermobility and forced/trained ('local') hypermobility if they are only palpating specific joints, where mfBIA may only detect naturally occurring hypermobility.

Comparing mfBIA with AMG revealed that both methods seem to be unreliable when used on the *gluteus medius* of a horse while standing. The mfBIA measurements can provide some useful data on the muscle, but as this measurement cannot distinguish between a muscle overworked because of hypermobility or training, the data can be unreliable. Using AMG on the *gluteus medius* while standing still did not provide a clear hypermobility assessment, as this muscle is not used to stabilize the horse.

However, this report has presented some useful data that can be used in future studies. To utilize assessments by physiotherapists, these must palpate the whole body of the horse, to

assess if the horse is ‘whole body’ or ‘local’ hypermobile. The usage of AMG should be further tested, using other muscles than the *gluteus medius* and on moving horses as well.

This study has contributed with important information to a better understanding of hypermobility in horses and has shown that this area should be studied further.

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Appendix

Appendix 1

Data collected from the physiotherapists. 'Where' and 'reason for treatment' is written in Danish, the rest has been translated.

Nr	Physiotherapist	Hypermobile	Non-hypermobile	Unknown	Whole body	Where	Gender	Age, years	Breed	Height, cm	Usage	Reason for treatment	Illness or injury	Check up	Problems when riding
1	Thesio 1	1			1	All	Mare	2	Icelantic horse	136	Young horse	Tjek efter styrt		1	
2	Thesio 1	1				Legs	Mare	15	Danish Sports pony	139	Jumping	Tjek		1	
3	Thesio 1			1			Gelding	10	Danish Sports pony	140	Jumping	Tjek		1	
4	Thesio 1	1			1	All	Gelding	6	Icelantic horse	143	Icelandic horse competition	Meget dårlig balence	1		
5	Thesio 1	1			1	All	Gelding	5	Icelantic horse	138	Breaking in	Siger fra i ridning			1
6	Thesio 1		1				Gelding	9	Danish warmblood	169	Dressage	Siger voldsomt fra i ridning			1
7	Thesio 1	1			1	All	Mare	11	Icelantic horse	138	Driving	Siger fra for vogn			1
8	Thesio 1	1			1	All	Gelding	13	Icelantic horse	141	Driving	Vælger altid pas aldring trav	1		
9	Thesio 1	1			1	All	Stallion	16	Welsh mountain	129	Jumping	Tjek		1	
10	Thesio 1			1			Gelding	6	Danish Sports pony	138	Jumping	Tjek		1	
11	Thesio 1			1			Mare	9	Danish Sports pony	138	Jumping	Tjek		1	
12	Thesio 1		1				Gelding	23	Fjord horse	145	Childs horse	Halt højre bag	1		
13	Thesio 1		1				Gelding	14	Danish warmblood	170	Dressage	Takter urent	1		
14	Thesio 1	1			1	All	Gelding	15	Icelantic horse	142	Dressage	Tjek		1	
15	Thesio 1	1			1	All	Mare	7	Icelantic horse	139	Icelandic horse competition	Siger fra i ridning			1
16	Thesio 1	1			1	All	Mare	13	Icelantic horse	138	Trail ride	Tjek		1	
17	Thesio 1	1			1	All	Mare	6	Icelantic horse	138	Young horse	Dårlig vejrtrækning	1		
18	Thesio 1		1				Mare	16	Danish warmblood	168	Dressage	Tjek		1	
19	Thesio 1	1			1	All	Gelding	11	Danish warmblood	180	Dressage	Boksskade	1		
20	Thesio 1	1			1	All	Gelding	6	Icelantic horse	139	Driving	Tjek		1	
21	Thesio 1		1				Gelding	21	welsh mountain	129	Childs horse	Halt	1		
22	Thesio 1	1			1	All	Gelding	6	Danish warmblood	172	Dressage	Tjek		1	
23	Thesio 1		1			-	Gelding	10	Danish warmblood	176	Dressage	Tjek		1	
24	Thesio 1		1			-	Mare	13	Danish warmblood	170	Dressage	Siger fra i ridnkng			1
25	Thesio 1	1			1	All	Mare	6	Icelantic horse	139	Trail ride	Dårlig vejrtrækning	1		
26	Thesio 1	1			1	All	Mare	13	Icelantic horse	136	Trail ride	Tjek af ny hest		1	
27	Thesio 1		1				Gelding	10	Danish warmblood	170	Dressage	Tjek		1	
28	Thesio 1	1				Legs	Gelding	4	Baroque Pinto	170	oung horse	Siger fra i tilridning			1
29	Thesio 2	1				Ryg	Mare	6	Holstener	173	Jumping	Generelle problemer ridning			1
30	thesio 2	1				Ben	Mare	15	Icelantic horse	140	Trail ride	Generelle problemer i ridning			1
31	Thesio 2		1			-	Gelding	18	Newforest	140	Allround	Årligt tjek		1	
32	Thesio 2		1			-	Gelding	10	Fjord horse	145	Trail ride	Tjek, stive bagben	1		

33	Thesio 2		1			-	Gelding	16	Mix	140	Allround	Generelle problemer ridning			1
34	Thesio 2		1			-	Mare	6	Arabian	155	Allround	Problemer efter sadel			1
35	Thesio 2	1				Ryg, især ben	Gelding	5	Danish warmblood	170	Dressage	Generelle problemer ridning			1
36	Thesio 2		1			-	Gelding	13	New forest	139	Dressage	Stiv, redet forkert tidl ejer	1		
37	Thesio 2		1			-	Gelding	8	Holstener	175	Dressage	Stiv, Generelle problemer ridning	1		1
38	Thesio 2	1			1	Generelt helkrops, mindre lumbalt	Gelding	7	Hanoverian	170	Dressage	Problemer efter sadel			1
39	Thesio 2	1			1	Helkrops, især bagben og thoracalt	Gelding	7	Danish warmblood	165	Dressage	Generelle problemer ridning			1
40	Thesio 2	1			1	Helkrop	Mare	5	Danish warmblood	175	Dressage	Instabilitet problem generelt			1
41	Thesio 2			1			Mare	12	Pinto	150	Dressage	Generelle problemer ridning			1
42	Thesio 2	1			1	Særligt thoracalt og lumbalt	Mare	6	Danish warmblood	163	Dressage	Tjek		1	
43	Thesio 2	1			1	Helkrop, særligt ben	Gelding	10	Icelantic horse	140	Icelandic horse competition	Generelle problemer ridning			1
44	Thesio 2	1			1	Helkrop, særligt ben	Mare	13	Icelantic horse	138	Trail ride	Generelle problemer i ridning			1
45	Thesio 2		1			-	Gelding	12	Welsh	155	Allround	Jævnligt tjek, PSSM hest		1	
46	Thesio 2			1		Thoracalt (først mærket ved 2. beh)	Mare	7	Danish Sports pony	149	Dressage	Pludselig uridelig			1
47	Thesio 2		1			-	Gelding	16	Pony mix	147	Trail ride	Vedligehold efter skade	1		
48	Thesio 2	1				Bagben	Gelding	7	Shetlands pony	105	Company	Tjek		1	
49	Thesio 2	1			1	Bagben, ryg	Mare	4	Holstener	168	Broken in	Generelle problemer ridning			1
50	Thesio 2	1				Ben	Mare	3	Danish Sports pony	145	Not ridden	Halthed	1		
51	Thesio 2		1			-	Gelding	22	Fjord horse	145	Leisure	Halthed	1		
52	Thesio 2		1			-	Mare	10	DW mix	162	Dressage	Generelle problemer i ridning			1
53	Thesio 2			1		Spatramt og gigt, inkonlusiv.	Mare	22	PRE	155	Retired	Stivhed, går besværet	1		
54	Thesio 2	1				Lænd og bagben	Gelding	6	PRE	155	Dressage	Generelle problemer ridning			1
55	Thesio 2			1		Meget dårlig i kroppen, alder,	Gelding	17	Danish warmblood	175	Jumping	Meget store problemer i ridning			1
56	Thesio 2			1		Gigtramt krop	Gelding	20	Danish warmblood	160	Dressage	Problemer ifb med spat og halthed	1		

57	Thesio 2			1			Gelding	8	Mix	155	Ground training	Ukendt historik, store biomekaniske udfordinrger	1		
58	Thesio 2		1			-	Mare	18	Danish warmblood	165	Dressage	Generelle problemer i ridning			1
59	Thesio 2	1				Forben	Mare	15	Danish warmblood	165	Dressage	Generelle problemer ridning			1
60	Thesio 2		1			-	Mare	15	Mix	145	Allround	Generelle problemer i ridning			1
61	Thesio 2	1			1	Helkrops	Mare	4	Arabian	148	Broken in	Skævt bækken	1		
62	Thesio 2	1			1	Ben, ryg	Mare	6	Danish warmblood	165	Dressage	Opfølgning efter skade og GOP forløb	1		
63	Thesio 2	1			1	Ben, ryg	Gelding	16	Icelantic horse	148	Trail ride	Generelle problemer ridning			1
64	Thesio 2	1			1	Ben, ryg	Gelding	3	Danish Sports pony	148	Not ridden	Tjek ifb. med handel		1	
65	Thesio 2	1			1	Helkrops	Mare	5	Danish Sports pony	149	Dressage	Generelle problemer ridning			1
66	Thesio 2	1			1	Ben, ryg	Mare	6	Danish warmblood	150	Dressage	Generelle problemer i ridning			1
67	Thesio 2			1		Synlig spat bilat	Gelding	29	DW/OLD	150	Leisure	Generelle problemer ridning			1
68	Thesio 2	1			1	Ben, ryg	Gelding	10	Icelantic horse	145	Unknown	Skade	1		
69	Thesio 2	1				Ben	Gelding	10	Danish warmblood	170	Dressage	Vedligehold efter skade (brækket griffelben, traumatisk)	1		
70	Thesio 2	1				Ben, især forben	Mare	14	Danish warmblood	165	Jumping	Tjek, forebyggelse		1	
71	Thesio 2	1				Ben	Gelding	9	Danish warmblood	170	Dressage	Hanetrit	1		
72	Thesio 2	1			1	Helkrops	Gelding	8	Danish warmblood	175	Dressage	Opfølgning efter halthedsforløb	1		
73	Thesio 2	1			1	Helkrops	Gelding	4	Danish warmblood	179	Dressage	Opleves ledløs i ridning, salg	1		
74	Thesio 2	1				Ben	Mare	8	Danish warmblood	175	Jumping	Generelle problemer i ridning			1
75	Thesio 2		1			-	Mare	10	Danish warmblood	165	Dressage	Opfølgning, generelle problemer ridning			1
76	Thesio 2	1				Ben	Gelding	9	Pony mix	149	Dressage	Generelle problemer ridning			1
77	Thesio 2		1			-	Mare	20	Knapstrubber	160	Trail ride	Uens forbens position, slid hove	1		
78	Thesio 2			1		Mulig atrose flere steder i kroppen	Gelding	7	Trotter mix	140	Allround	Generelle problemer ridning: Slår fra			1
79	Thesio 2	1			1	Helkrops	Mare	12	Holsteiner	170	Dressage	Siger kraftigt fra			1
80	Thesio 2			1	1	Helkrops især bagben. Ryg	Gelding	7	Icelantic horse	145	Icelandic horse competition	Generelle problemer ridning			1

81	Thesio 2	1			1	Helkrops især ben	Gelding	11	Icelantic horse	136	Icelandic horse competition	Sadel problemer			1
82	Thesio 2	1				Forben og bagben	Stallion	13	Icelantic horse	144	Icelandic horse competition	Prob. hypermobile forben	1		
83	Thesio 2	1			1	Helkrops	Gelding	9	Icelantic horse	140	Icelandic horse competition	Generelle problemer ridning			1
84	Thesio 2			1		Mangler meget stab. mm. I tvivl om	Mare	9	Icelantic horse	142	Icelandic horse competition	Generelle problemer ridning			1
85	Thesio 2	1				Let hypermobil i benene.	Gelding	11	Icelantic horse	148	Allround	Generelle problemer ridning			1
86	Thesio 2	1				Bagben	Gelding	14	Danish warmblood	178	Dressage	Massive problemer ridning. Siger fra			1
87	Thesio 2		1			-	Gelding	1	Danish Sports pony	130	Not ridden	Uforklarlig halthed (dyrlæge udredt først)	1		
88	Thesio 2		1			-	Gelding	14	Danish warmblood	170	Dressage	Opfølgning/forebyggende tjek		1	
89	Thesio 2	1			1	Helkrops	Mare	8	Icelantic horse	135	Icelandic horse competition	Generelle problemer ridning, siger fra			1
90	Thesio 2		1			-	Mare	14	Holsteiner	175	Jumping	Generelle problemer ridning, vil ikke springe			1
91	Thesio 2	1				Forben	Gelding	5	Danish warmblood	175	Allround	Forebyggende besøg		1	
92	Thesio 2	1					Mare	4	Danish warmblood	165	Broken in	Traume: Siddet fast i bokslåge			
93	Thesio 2			1	1	Helkrops (meget ung i skelettet,	Stallion	2	Danish warmblood	145	Not ridden	Galopperer med samlede ben.	1		
94	Thesio 2	1					Mare	24	Icelantic horse	135	Allround	Genoptræning: Forfangenhedsforløb	1		
95	Thesio 2	1			1	Helkrops, især ben	Gelding	8	Icelantic horse	140	Broken in	Kyler alle af			1
96	Thesio 2		1			-	Gelding	12	Holsteiner	170	Military	Genoptræning efter skade	1		
97	Thesio 2		1			-	Mare	14	Holsteiner	164	Military	Opfølgning/forebyggende tjek		1	
98	Thesio 2	1			1	Helkrops	Gelding	12	Icelantic horse	145	Allround	Skævt kryds	1		
99	Thesio 2	1			1	Helkrops. Meget udpræget	Gelding	3	Danish warmblood	175	Not ridden	Meget skævt kryds	1		
100	Thesio 2	1			1	Helkrops, meget udpræget	Gelding	8	Danish warmblood	178	Dressage	Forebyggende tjek. Mindre udfordringer i ridnigen			1
101	Thesio 2	1			1	Helkrops, meget udpræget	Mare	4	Unknown		Broken in	Generelle problemer ridning			1
102	Thesio 2		1			-	Gelding	12	Holsteiner	175	Dressage	Opfølgning/forebyggende tjek		1	
103	Thesio 2		1			-	Mare	10	Danish warmblood	165	Dressage	Generelle problemer ridning			1
104	Thesio 2		1			-	Mare	7	Danish warmblood	165	Allround	Generelle problemer ridning, massiv stiv	1		1
105	Thesio 2	1			1	Helkrops, meget	Gelding	8	PRE	160	Dressage	Mangler muskulatur	1		
106	Thesio 2		1			-	Mare	8	Fjord horse	145	Allround	Forebyggende besøg		1	
107	Thesio 2	1			1	Helkrops	Mare	3	Quarter	160	Broken in	Forebyggende besøg		1	
108	Thesio 2	1			1	Helkrops	Mare	4	Danish Sports pony	140	Dressage	Generelle problemer ridning: Meget stiv	1		1
109	Thesio 2		1			-	Mare	10	Warmblood mix	165	Allround	Opfølgning		1	
110	Thesio 2		1			-	Gelding		Frieser	160	Dressage	Skævt bækken	1		
111	Thesio 2		1			-	Mare	14	DW/Holsteiner	170	Jumping	Traume: Faldet på springbanen			
112	Thesio 2	1			1	Helkrops, mest udpræget forben	Gelding	4	Danish warmblood	165	Allround	Generelle problemer i ridning:,Siger kraftigt fra			1
113	Thesio 2			1		-	Mare	7	Danish warmblood	170	Dressage	Generelle problemer ridning, stiv	1		1
114	Thesio 2	1			1	Helkrops, især ben	Gelding	5	Icelantic horse	142	Trail ride	Udadroterer forben	1		
115	Thesio 2	1				Forben	Gelding	15	Fjord horse	148	Dressage	Forebyggende besøg		1	
116	Thesio 2	1			1	Helkrops, især ben	Mare	5	Icelantic horse	145	Icelandic horse competition	Genrelle problemer i ridningen			1
117	Thesio 2		1			-	Mare	15	Icelantic horse	145	Allround	Genrelle problemer i ridningen			1
118	Thesio 2	1			1	Helkrops	Mare	8	Icelantic horse	138	Icelandic horse competition	Genrelle problemer i ridningen			1
119	Thesio 2			1		Muligvis bagben	Mare		Danish warmblood	165	Dressage	Opfølgning; Massivt skævt bækken	1		
120	Thesio 2	1				Bagben	Mare	9	Danish warmblood	165	Dressage	Genrelle problemer i ridningen, sætter ikke muskler	1		1
121	Thesio 2	1				Bagben	Gelding	14	Pony mix	139	Dressage	Skadet: Dybe bøjesene forben- overbelastning	1		
122	Thesio 2		1			Obs Spat bilat.	Gelding	15	Old. Mix	168	Allround	Opfølgning: Markant stiv	1		
123	Thesio 2	1				Ben	Gelding	14	Danish Sports pony	139	Allround	Opfølgning: Generelle problemer ridning			1
124	Thesio 2		1			-	Mare	20	Danish warmblood	165	Dressage	Skævt kryds	1		
125	Thesio 2	1					Gelding	8	Icelantic horse	145	Allround	Generelle problemer ridningen: Stiv	1		1
126	Thesio 2		1			-	Mare	12	Danish warmblood	165	Military	Opfølgning; Genrelle problemer ridning			1
127	Thesio 2		1			- Obs. formentlig en del Atrose	Gelding	18	Danish warmblood	165	Dressage	Opfølgning: Markant stivhed	1		
128	Thesio 2	1			1	Helkrops, meget udpræget	Gelding	10	Danish warmblood	170	Dressage	Opfølgning		1	
129	Thesio 2	1				Forben og overlinje	Mare	12	Danish warmblood	175	Dressage	Generelle problemer ridning			1

130	Thesio 2		1			- Obs gl. skade bagben	Gelding	15	Holsteiner	165	Dressage	Generelle problemer ridning			1
131	Thesio 2	1				Ben	Gelding	5	Icelantic horse	140	Broken in	Forebyggende besøg		1	
132	Thesio 2	1			1	Helkrops	Stallion	6	Icelantic horse	145	Icelandic horse competition	Generelle problemer ridning			1
133	Thesio 2	1			1	Helkrops	Gelding	11	Icelantic horse	140	Icelandic horse competition	Opfølgning		1	
134	Thesio 2	1			1	Helkrops	Mare	7	Icelantic horse	140	Icelandic horse competition	Generelle problemer ridning			1
135	Thesio 2	1			1	Helkrops	Mare	11	Icelantic horse	142	Icelandic horse competition	Generelle problemer ridning			1
136	Thesio 2	1			1	Helkrops	Mare	13	Icelantic horse	140	Trail ride	Generelle problemer ridning			1
137	Thesio 2	1			1	Helkrops	Gelding	14	Miniature	45	Company	Forebyggende		1	
138	Thesio 2		1			-	Gelding	15	Pinto	152	Trail ride	Generelle problemer ridning			1
139	Thesio 2		1			-	Gelding	16	Danish warmblood	165	Trail ride	Generelle problemer ridning			1
140	Thesio 2		1			-	Mare	6	Haflinger	148	Allround	Forebyggende besøg		1	
141	Thesio 2		1			-	Gelding		Oldenburger	165	Allround	Forebyggende besøg		1	
142	Thesio 2	1			1	Helkrops, meget udpræget	Gelding	4	Danish warmblood	170	Dressage	Post OP, sædstrengs adhærence	1		
143	Thesio 2	1			1	Helkrops, meget udpræget	Gelding	6	PRE	160	Dressage	Post OP, sædstrengs adhærence	1		
144	Thesio 2			1			Mare	6	A. Curly	150	Not ridden	Uforkarlig halthed, er dyrlæge udredt	1		
145	Thesio 2		1			- Obs Atrose	Gelding		Pony mix	145	Allround	Generelle problemer ridning, markant stiv	1		1
146	Thesio 2		1			-	Gelding	15	Pony mix	150	Allround	Generelle problemer ridning			1
147	Thesio 2	1				Ben	Mare	16	Danish Sports pony	145	Jumping	Generelle problemer ridning			1
148	Thesio 2		1			Spat, atrose	Mare	18	Icelantic horse	130	Allround	Generelle problemer ridning			1
149	Thesio 2		1			Spat, atrose	Gelding	18	Danish Sports pony	140	Allround	Uforklarlig halthed, er dyrlæge udredt	1		
150	Thesio 2	1			1	Helkrops, meget udpræget	Gelding	5	Danish warmblood	170	Dressage	Uforkarlig halthed, er dyrlæge udredt	1		
151	Thesio 2		1			-	Gelding	25	Danish warmblood	170	Retired	Stivhed	1		
152	Thesio 2		1			-	Gelding	19	Danish warmblood	165	Distance	Generelle problemer i ridning			
153	Thesio 2	1				Helkrops	Mare	5	Arabian	150	Broken in	Skævt kryds	1		
154	Thesio 2	1				Ben	Gelding	8	Newforest	149	Allround	Smeden kan ikke løfte bagbenene			
155	Thesio 2			1		-	Mare	4	Haflinger	145	Allround	Sadelproblemer			1
156	Thesio 2	1					Mare	6	Lippizaner	150	Dressage	Generelle problemer i ridning			1
157	Thesio 2		1			-	Mare	9	Danish Sports pony	149	Allround	Generelle problemer ridning			1
158	Thesio 2	1				Dog markbar atrose bagben	Mare	23	Icelantic horse	135	Allround	Uforkarlig halthed, er dyrlæge udredt	1		
159	Thesio 2	1				Forben	Mare	16	Icelantic horse	130	Allround	Smeden kan ikke løfte bagbenene	1		
160	Thesio 2	1					Gelding	5	Fjord horse	150	Allround	Traume: Gledet, halt (udredt hos dyrlægen)	1		
161	Thesio 2			1		Meget ungt skelet	Stallion	1	Haflinger	130	Not ridden	Traume: Gledet, halt (udredt hos dyrlægen)	1		
162	Thesio 2	1				Ben, Meget udpræget i forknæ	Mare		Frieser	165	Allround	Forebyggende besøg		1	
163	Thesio 2	1			1	Helkrops	Gelding	6	Danish warmblood	168	Dressage	Skævt kryds	1		
164	Thesio 2	1				Ben	Mare	8	Danish Sports pony	149	Dressage	Sadelproblemer			1
165	Thesio 2	1			1	Helkrops, meget udpræget	Gelding	10	Danish warmblood	180	Dressage	Sadelproblemer, Generelle problemer ridning			1
166	Thesio 2		1			-	Gelding	12	Holsteiner	175	Jumping	Generelle udfrodringer i ridning			1
167	Thesio 2		1			-	Gelding	9	Mix	160	Allround	Meget stiv	1		
168	Thesio 2	1			1	Helkrops, meget udpræget	Gelding	5	Danish warmblood	170	Dressage	Generelle problemer ridning			1
169	Thesio 2	1			1	Helkrops, meget udpræget	Mare	4	Danish warmblood	164	Dressage	Skade forben, Generelle problemer ridning	1		1
170	Thesio 2	1				Forben	Mare	8	Fjord horse	140	Allround	Generelle problemer ridning			1
171	Thesio 2	1				Ben	Mare	7	Holsteiner	170	Allround	Generelle problemer ridning			1
172	Thesio 2	1			1	Helkrops, meget udpræget	Mare	11	Danish warmblood	165	Dressage	Massive problemer ridning, siger fra			1
173	Thesio 2		1			-	Mare	9	Danish warmblood	165	Dressage	Sadelproblemer, Generelle problemer ridning			1
174	Thesio 2	1			1	Helkrops, meget udpræget	Gelding	6	Danish Sports pony	149	Dressage	Generelle problemer ridning, sadelproblemer			1
175	Thesio 2		1			-	Gelding	12	Danish warmblood	168	Dressage	Generelle problemer ridning			1
176	Thesio 2		1			-	Gelding	16	Oldenburger	173	Dressage	Generelle problemer ridning			1
177	Thesio 2	1				Ben	Gelding	12	Danish warmblood	170	Dressage	Generelle problemer ridning			1

178	Thesio 2	1					Gelding	10	Danish warmblood	170	Allround	Generelle problemer ridning			1
179	Thesio 2	1			1	Helkrops, meget udpræget	Mare	9	Danish warmblood	168	Dressage	Skadet efter været i ridning	1		
180	Thesio 2	1				Ben	Mare	8	Icelantic horse	140		Problemer efter foling	1		
181	Thesio 2		1			-	Gelding	11	Danish warmblood	165	Dressage	Generelle problemer ridning			1
182	Thesio 2			1			Gelding		Icelantic horse	140	Allround	Generelle problemer ridning			1
183	Thesio 2		1			-	Mare	5	Danish warmblood	170	Dressage	Forebyggende besøg		1	
184	Thesio 2	1			1	Helkrops	Mare	11	Danish warmblood	170	Dressage	Generelle problemer ridning			1
185	Thesio 2	1			1	Helkrops	Gelding	8	Danish warmblood	175	Dressage	Generelle problemer ridning			1
186	Thesio 2	1			1	Helkrops, meget udpræget	Gelding	5	Danish warmblood	175	Dressage	Skævt kryds efter skades forløb	1		
187	Thesio 2	1			1	Helkrops	Mare	6	Danish warmblood	170	Dressage	Generelle problemer ridning			1
188	Thesio 3	1				Forehand, neck	Gelding	8	Icelantic horse	137	Trail ride and therapy	Tjek		1	
189	Thesio 3	1				Forehand, neck	Mare	14	Icelantic horse	140	Trail ride	Tjek		1	
190	Thesio 3		1			-	Gelding	16	Icelantic horse	138	Trail ride	Tjek		1	
191	Thesio 3	1				Forehand	Mare	5	Icelantic horse	137	Trail ride	Tjek		1	
192	Thesio 3	1				Forehand	Gelding	11	Icelantic horse	138	Trail ride	Tjek		1	
193	Thesio 3	1			1	Forehand, hindquaters, back	Gelding	13	Icelantic horse	142	Trail ride	Tjek		1	
194	Thesio 3		1			-	Gelding	17	Icelantic horse	140	Trail ride	Tjek		1	
195	Thesio 3	1				Forehand,	Gelding	13	Icelantic horse	138	Trail ride	Tjek		1	
196	Thesio 3	1				Forehand,	Mare	14	Icelantic horse	138	Trail ride	Tjek		1	
197	Thesio 3	1				Forehand,	Gelding	20	Icelantic horse	140	Trail ride	Tjek		1	
198	Thesio 3	1				Forehand	Mare	17	Icelantic horse	137	Trail ride	Tjek, problem med forben	1		
199	Thesio 3			1		Forehand	Gelding	11	Icelantic horse	138	Trail ride	Tjek		1	
200	Thesio 3	1				Forehand	Gelding	13	Oldenburger	178	Trail ride				
201	Thesio 3		1			-	Gelding	9	Danish warmblood	176	Dressage				
202	Thesio 3		1			-	Gelding	9	German warmblood	172	Dressage				
203	Thesio 3		1			-	Mare	8	Hanoverian	174	Dressage				
204	Thesio 3		1			-	Gelding	5	Sportspony	146	Dressage				
205	Thesio 3		1			-	Mare	13	Danish warmblood	164	Dressage				
206	Thesio 3		1			-	Gelding	14	Zangersheide	173	Military				
207	Thesio 3			1		-	Mare	14	Danish warmblood	164	Dressage				
208	Thesio 3		1			-	Mare	-	Danish warmblood	166	Military	Problem, halt v. forben	1		
209	Thesio 3		1			-	Gelding	7	Dutch warmblood	172	Military	Problem, skøvt kryds	1		
210	Thesio 3	1			1	Whole body	Gelding	7	Icelantic horse	141	Dressage	Kæbe klikker	1		
211	Thesio 3		1				Mare	19	Danish warmblood	163	Hunting	Op til konkurrence		1	

212	Thesio 3		1				Gelding	17	Irish Cob	155	Trail ride				
213	Thesio 3		1				Gelding	13	Danish warmblood	165	Dressage	Rytter glider	1		
214	Thesio 3		1				Mare	13	Unknown	168	Military	tidligere skadet	1		
215	Thesio 3	1				Whole body	Mare	12	Icelantic horse	150	Trail ride	Hoster	1		
216	Thesio 6			1			Gelding	8	Fell pony	141	Trail ride	urolig hoved, svær i galop			
217	Thesio 6		1				Mare	13	Fjord horse	142	Allround	Problemer ve volte			1
218	Thesio 6		1				Gelding	21	Welsh Mountain	121	Retired	Tjek pga stivhed bagpart	1		
219	Thesio 6			1		Forehand	Mare	3	Warlander	156	Breaking in	Tjek inden tilridning		1	
220	Thesio 6	1			1	Forehand, back,	Gelding	20	Irish Cob	136	Trail ride	Gigt ve. baghas, Cushing	1		
221	Thesio 6	1			1	All	Mare	7	Irish Cob	140	Therapy horse	Sur på ve volte, Dysfunktion ve side ilium og Sacrum	1		1
222	Thesio 6	1			1	All	Stallion	9	Drumhorse	173	Dressage	Begyndt at tisse ofte	1		
223	Thesio 6		1				Mare	14	Irish sports pony	143	Jumping	Halt ve for	1		
224	Thesio 6		1				Mare	13	Arabian	152	Allround	Igang efter pause		1	
225	Thesio 6	1				Forehand, neck	Mare	10	Danish warmblood	167	Dressage	Stivhed ve volte	1		
226	Thesio 6			1			Gelding	7	Danish warmblood	176	Dressage	Stivhed gang, utaktet og nedsat rygsving efter dårlig sadel	1		