Gotland ponies on extensive pastures – a welfare assessment

Gotlandsruss på extensiva beten - en välfärdsstudie

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Sammanfattning

Det finns möjlighet för svenska lantbrukare att få ersättning genom EU:s landsbygdsprogram genom att hålla djur på extensiva naturbeten och genom att främja mångfald bland djur och växter. Enligt reglerna får dessa djur inte stödutfodras men samtidigt säger Svenska djurskyddslagen och Jordbruksverkets författningar att djur, i detta fall hästar, ska utfodras med foder av bra kvalitet, anpassat för arten. De ska även utfodras individuellt och givan ska inte resultera i övervikt eller undervikt.

Syftet med detta masterprojektet har därför varit att undersöka om hästar av rasen gotlandsruss klarar av att hållas på extensiva beten med bibehållen djurvälfärd under sen vår och sommar. Ponnyerna observerades var fjärde vecka enligt ett protokoll i linje med Welfare Quality® (submitted, Viksten et al.), fysiska, beteendemässiga och resursbaserade parametrar observerades.

I studien ingick tolv ettåriga gotlandsrusshingstar inköpta från olika uppfödare. Hästarna delades in i tre grupper och släpptes i tre likvärdiga inhägnader i storleken åtta till tio hektar som bestod av en tredjedel åker och två tredjedelar skog. Studien utfördes maj till augusti 2014 som en del av det större projektet ” The Gotland pony as a conservationist – a way to promote the biodiversity and to conserve an endangered breed” som startade 2014 och beräknas pågå under två år.

De fysiska parametrarna som bedömdes var hull, eventuella sårskador, hudproblem, skav på huden samt man/svans- och pälskvalitet. Även andning, rinnande ögon och nos, skick på hovar, hälta samt hästarnas termiska komfort observerades. Beteendebedömningen utfördes genom ett ”human approach test” (hur hästarna förhöll sig till människors närmanden) och ett ”avoidance distance test” (hur nära hästarna tillät människor) samt ett generellt intryck av hästarnas beteende.

Resultatet visade att flera av de undersökta parametrarna påverkades antingen till det bättre eller sämre med tiden, däremot hade det mindre betydelse vilken grupp hästarna tillhörde. Hästarnas hull bedömdes på en skala 0-5 med halvpoäng och under tiden studien pågick ökade hullpoängen för samtliga individer. Förekomsten av skav i man och svans ökade liksom observerade hudproblem. Antal sår och pälskvalitet förbättrades allteftersom studien fortskred. Hästarna visade ingen tendens till att ha problem med andning, sin termiska komfort eller hälta och det fanns inga tendenser till allvarliga fysiologiska välfärdsproblem. Med tiden blev samtliga hästar lättare att hantera, det var bara i en av grupperna som hästarna visade på undvikande beteende när de närmades och de skiljde sig därmed från resterade grupper.

Studien visade att hästar av rasen Gotlandsruss klarar av att gå på extensiva beten med bibehållen god djurvälfärd under vår och sommarperioden. Fortsatta studier behöver dock genomföras för att undersöka hur hästarna klarar av hårdare klimat under höst och vinter när tillgången på föda är begränsad.

Nyckelord: Welfare Quality, djurvälfärd, häst, ferala hästar, extensivt bete, beteende, fysiologi, BCS

Abstract

Swedish farmers have the possibility to be subsidized by EU rural development programme for grazing animals on pastures to promote the biodiversity of flora and fauna. The environmental remedy sometimes does not allow supplementary feed and at the same time the Swedish Animal Welfare Act and the Swedish Agricultural Board's regulations for animal welfare and protection states that animals, in this case horses, shall be fed with food of good quality and adapted for the species. The regulations also state that they should have an individual feeding regime that enables them to maintain a normal body condition.

The aim with this master thesis has been to investigate if it is possible to keep Gotland ponies on extensive pastures, during late spring and summer and still maintain animal welfare. The horses were assessed every fourth week using a welfare assessment protocol developed in line with the Welfare Quality® project (submitted, Viksten et al) where physical, behavioural and resourcebased parameters were observed.

Twelve one-year old stallions of the breed Gotland ponies purchased from different breeders were used in the study. They were divided into three groups and released in equivalent enclosures of the size eight to ten acres, consisting of one third field and two third forests. The study was performed during May to August 2014 as a part of the larger project "The Gotland pony as a conservationist – a way to promote the biodiversity and to conserve an endangered breed" which started in 2014 and is estimated to run over two years.

The physical assessment consisted of body condition scoring, registration of signs of lesions, skin problems, chafing, mane/tail- and coat quality, respiration, thermal comfort, eye- and nostril discharge, hoof health and lameness. The behavioural assessment was performed by a human approach test and an avoidance distance test when the horses were approached and their interest in humans was recorded as well as if it was possible to touch the horses or if they were avoiding people.

The results showed that most of the studied parameters were affected as the study proceeded. However, which group the horses belonged to had no effect. Body condition score increased for all individuals with time. The prevalence of broken hairs in mane/tail as well as skin problems increased with time. Number of lesions decreased and coat quality was improved. The horses did not show any welfare problems regarding their respiration, their thermal comfort or lameness and there was no indication of severe welfare problems. With time the horses got easier to handle and only one group of horses showed avoidance pattern.

The study showed that Gotland ponies can manage on extensive pastures with maintained good animal welfare during late spring and summer, but further tests have to be carried out during fall and winter to study the welfare under harsher conditions.

Keywords: Welfare Quality, animal welfare, horse, feral horse, extensive pasture, behaviour, physiologic, BCS

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1. Introduction

This master thesis is a part of the larger project ”The Gotland pony as a conservationist – a way to promote the biodiversity and to conserve an endangered breed”. In the project, the horses are kept on extensive pastures to promote biodiversity without provision of supplementary feed. The question is; can this be done with maintained animal welfare?

Sweden has 16 national environmental goals and one of these goals is: “a rich and varied rural landscape” which aims to enhance the biodiversity of the flora and fauna. To maintain biodiversity and an open landscape the agriculture has an important role. The environmental support is a part of the rural development program and subsidy is paid to farmers who want to improve the environment and the biodiversity (Swedish Government, 2012; SJVFS 2013:46). To receive subsidies the farmer shall develop the Swedish agriculture and use environmentally friendly methods. One way farmers can receive support is by grazing animals on their natural grasslands (Swedish Board of Agriculture, 2014). Since horses have a good ability to utilize pastures with high amount of fiber and different quality of the energy content, they have the possibility to graze and manage on multiple plants and pasture types.

The original project intends to study how the biodiversity is affected by grazing Gotland ponies and at the same time figure out how to maintain and protect an endangered breed. To maintain the natural grassland without sowing of foreign herbs and plants, no supplementary feed is allowed (Swedish Government, 2012; SJVFS 2013:46).

According to the Swedish Animal Welfare Act (SFS 1988:534) and the Swedish Agricultural Board’s regulations (DFS 2007:6 L101), animals should be fed with sufficient amounts of feed and water of good quality, adapted to the species. Stables and other animal shelter shall contain enough space and offer protection (SFS 1988:534) and the hooves should be controlled regularly and trimmed when necessary (DFS 2007:6 L 101). The Swedish Agricultural Board’s regulations for keeping horses state that they shall be fed individually with a well-balanced ration and with a daily meal that gives enough occupation and enough fiber. The regulations also state that the feed shall enable the horses to maintain a normal body condition (DFS 2007:6 L 101).

In order to receive environmental subsidies from the rural development program, animals kept on extensive pastures should not be given supplementary feed (Swedish Government, 2012; SJVFS 2013:46). This may be a problem when the legislation requires supplementary feed for horses when needed and thereby the regulations about animal welfare are not met when keeping horses on these types of pastures.

The aim with this master thesis was to investigate the possibility to keep Gotland ponies on extensive pastures with maintained animal welfare during late spring and summer. The horses were observed and assessed every fourth week with a protocol developed in line with Welfare Quality® by Viksten et al. (submitted). Animal- and resource-based parameters were assessed.

The hypotheses are: it is possible to keep Gotland ponies on extensive pastures during late spring and summer with maintained animal welfare; the horses will maintain an acceptable BCS; the horses will seek shelter from insects and bad weather; there are no welfare differences between the groups of horses; according to the individual horses the behavioural

parameters differ between the groups; the horses most easy to handle at the beginning of the project are the most easy to handle later on and the remaining horses are more hard to handle.

1.1 The Gotland pony

Gotland ponies are the only Swedish indigenous breed and one of the oldest European breed, known to have existed for more than 6000 years (Erixon, 2012). Since the beginning of the 1900th century, horses have been kept free-ranged on Lojsta hed, Gotland, Sweden and today the herd consists of around 50 mares, a stallion and their offspring. The horses on Lojsta are kept on 650 acres, divided into three enclosures. Their natural pasture is supplemented with hay every second day during the late fall and winter months. The breed is known as a robust, tough and healthy horse that can manage on poor pastures (Erixon, 2012). The horses have a low size at withers ($\leq$ 130 cm), a low body weight and will therefore not damage the ground and harm the plants as more heavy breeds. The Gotland pony is considered an endangered breed and the Swedish Board of Agriculture has on behalf of the Food and Agriculture Organization (FAO) stated that the breed is worth to conserve (FAO, 2007; Swedish Board of Agriculture. 2007). Giving Gotland ponies the task to graze on extensive pastures might be a way to increase usability of the breed and save it from extinction.

2. Literature study

2.1 What is animal welfare

Sight of stereotypies is a usual way to assess animal welfare in confined animals, although some authors question this (Mason & Latham, 2004). They claim that it is not necessary that an animal displaying stereotypical behavior has a lower welfare than an animal without any stereotypies (Mason & Latham, 2004). Littin et al. (2004) are of the opinion that animal welfare depends on many factors and when welfare is good, suffering is absent. The authors define animal welfare as when an animal's nutritional, environmental, health, behavioral and mental needs are met (Littin et al., 2004). This means that animal welfare does not only include physical health, it also includes mental well-being. The definition of Littin et al. (2004) is in accordance with the five freedoms which include freedom from hunger and thirst, freedom from discomfort, freedom from pain, injury and disease, freedom to express normal behavior as well as freedom from fear and distress (Rollin, 2011).

The European Union has taken the initiative to improve animal welfare (Animal Welfare Action Plan 2006-2010) through projects like Welfare Quality® (WQ®) which was an EU-funded research project aimed to increase animal welfare in the food producing chain that ran from 2004 to 2009. The project also developed several protocols that cover the consumers concerns about animal welfare as well as the market demands. WQ® protocols are developed for some farm animals, but not especially for horses. The WQ® protocol is based on four principles: good feeding, good housing; good health and appropriate behaviour and includes twelve criterias. The project points to a combination of resource-based and animal-based measures as the most valuable and necessary when controlling animal welfare (Blokhuis et al., 2003, Blokhuis, 2008).

2.2 Body condition score among feral horses

Limited resources of food and water are the most common animal welfare problems among free-ranged horses (Kane, 2011). Body condition score (BCS) for feral horses vary depending on the amount of rain, location and the nutritional value of the pasture (Rudman & Keiper,

1991; Hampson et al., 2011). Hampson et al. (2011) studied remains of feral horses from five locations in Australia from October 2008 until March 2009. Each location was unique when it came to vegetation and soil type and varied from forested to semiarid desert, savannas, and tropical coast. The horses were of light thoroughbred type and consisted of a total of 41 cadavers, 24 males and 17 females with an age that varied from one to 18 years. The scientists scored BCS using a scale from one to nine where five was moderate and they also studied stomach content. The conclusion was that BCS varied between locations, but overall, all horses were assessed to be moderate thin (mean 3.9) with a variation from 2.67 ± 0.21 to 4.90 ± 0.28 in the worst and best location. Another result was that males had a one to three point's higher BCS than females, which is in agreement with the results of Rudman & Keiper (1991). The amount of protein in the stomach content differed between 4.3 % and 14.9 % in horses from the various locations. The amount of protein and fat in the stomach content were significant related to BCS when all horses were assessed as one group. In some locations the mean amount of protein in the stomach content was higher than the recommended daily intake and it was also those horses that had the highest BCS and vice versa. There was no significant interaction between age and location on BCS. Observations made over a longer period showed that the horses were never obese. The samples from different locations were taken during various periods which could have affected the results. Some samples were taken after extended dry periods and some in the end of spring or summer when the feed had a higher amount of protein, which affects the BCS (Hampson et al., 2011).

The results of Rudman & Keiper (1991) indicate that lactating mares had the lowest BCS compared to stallions and non-lactating mares. They studied BCS (on a scale zero to five) on feral horses on the Assateague Island, and its correlation to gender, reproductive status and locations. Rudman & Keiper (1991) studied two groups of horses, one on the southern part of the island and one on the northern part. The studies were carried out in two periods, the first in June 1988, including 47 adult horses and later in February- March 1989, including 36 adults. The horses were not given any supplementary feed. The southern part of the island consisted of good shelter from rain and plentiful of feed in contrast to the northern part which had worse pastures and shelter. The result showed that the horses on the southern part had a higher BCS in the summer than those on the northern part with limited resources, but they found no other significant differences over season. Rudman & Keiper (1991) concluded that gender, reproductive status and location all had an effect on BCS but season had not. When newly released Przewalski horses were observed in Mongolia from May until September, BCS was recorded among other things. The horses either held or increased their BCS although the authors expected a decrease in BCS in the beginning as a result of an explorative phase (Souris et al., 2007).

The low BCS of feral horses may be a result of intestinal parasites (Hampson et al., 2011) but also long distances travelled by the horses between feed and water sources (Hampson et al., 2010). Hampson et al. (2010) studied twelve feral horses from different bands in two locations in Australia using GPS. The result showed that there was a large variation in distance travelled per day with an average daily distance of 15.9 ± 1.9 km/day. In one of the locations the horses travelled almost the same distance each day as a result of good grazing areas nearby the water points, and they were never observed far away from the water. In the other location the horses were seen 15-55 km away from the water point. There were no significant differences between the groups in distance travelled. The frequency of visiting the water points differed between the groups; the horses with grazing areas close to water visited the water points with a frequency of 2.1 ± 0.9 days where the horses that grazed in another area had a longer frequency (3.2 ± 0.8 days).

2.3 Welfare assessments in free-ranged horses

A study by Mullan et al. (2014) observed free-ranged and long-line tethered horses in South Wales. The assessment included quantitative and qualitative behavior measurements, physical measurements as well as assessments of the environment. They observed 75 tethered horses and 112 free-ranged horses for a total of 1062 observations in a six months period from March to August. They performed a human approach test and an avoidance distance test and found that the free-ranged horses mostly moved away when they were approached (58.0 % of the times) and that it was possible to touch them for 34.2 % of the times. No aggressive behaviors directed towards the test person were seen during these tests. The scientists saw no severe physical problems in any of the free-ranged groups. The most observed physical problems among the free-ranged horses were mane and tail tangles (54.2 %) which were not seen as a real welfare problem, followed by eye abnormalities (28.7 %) and a BCS less than 2 (19.2 %) on a scale zero to five. The tethered horses, were tethered either by a neck strap or head collar. The most common material for the tether was webbing followed by rope and leather. Lesions were in some cases associated with the neck straps or head collars but no differences in frequency of lesions were seen between the materials. The free-ranged horses had access to shelter at almost all observations which differed from the long-line tethered horses which just had access to shelter in 16.5 % of the observations. A similar study performed by Samuel et al. (2012) also observed free-ranged horses in South Wales for six weeks. The horses consisted of 16 individuals whereof four were kept free-ranged throughout the study. The physical measures observed included rainscald, hoof overgrowth, hoof cracks, lameness, limb dirtiness, body dirtiness, number of lesions and BCS. Rainscalds were observed in 37 % of the observations and the prevalence varied on a weekly basis from 0 - 82 % depending on weather. This high prevalence was probably caused by the lack of shelter (Samuel et al., 2012) since rainscalds usually occur in connection with prolonged wetting of the hair (Pilsworth & Knottenbelt, 2007). The results of Samuel et al. (2012) also showed 33 % hoof overgrowth, 40 % hoof cracks, 18 % lameness and the mean score of limb dirtiness was two out of four (continuous dirt up to mid-cannon), mean score of body dirtiness was two out of four (largest part of dirt between hand print and forearm length). The horses were given supplementary feed and the mean BCS was 3.5 on a scale zero to five.

2.4 Insects

Insects are a problem for feral horses and all livestock kept on pasture as they can lower their fitness and welfare as well as cause chronic irritation to sensitive body parts as eyes, nostrils and also causing pain through bites. Insect harassment may also interrupt the grazing which can result in lower BCS (Gorecka & Jezierski, 2007). When behavior among horses exposed to insects was studied and compared with horses kept either in a forest reserve or on pasture, it showed that the horses in the forest reserve were more affected and showed more irritated behavior than the ones on the pasture. The insect pressure was highest during hot weather and sunshine as well as cloudy weather, and a lower insect pressure was seen during rainy and cold weather conditions (Gorecka & Jezierski, 2007). Similar results were given by Keiper & Berger (1982) which showed that the irritated behavior occurred less frequently on beaches and island bays on the island and on higher slopes and ridges in the desert environment. They observed that the horses chose to rest where it was a lack of vegetation, higher wind velocities and lower ambient temperature. Mooring & Hart (1992) indicated that grouping of animals may reduce the attacks by flying parasites and that the animal in the center has a lower number of bites then the rest of the group members. The same results were given by Duncan & Vigne (1979) who studied the number of bites from blood suckling flies in relation to group size in Camargue horses. They observed two groups of three individuals and one larger group

of 36 individuals. The result indicated that the horses in the smaller groups had more bites then the ones in the larger group.

2.5 Acclimatization to temperatures

In a study by Holcomb et al. (2013) they assessed the physiological response to heat for horses that had no access to shade compared with horses that were completely in shade. The horses without any access to shade reacted with higher rectal temperature, higher respiration rate, higher skin temperature and they exhibited more sweat than the other group. A later study, by the same authors, observed twelve horses, and if they preferred to be in the shade or not during hot sunny days. The horses were kept in dry lot pens of 75 m^2 and half of the area was shaded and the other half was not. Their results showed that horses were observed in the shade more often than expected by chance and both foraging and locomotor behavior ocurred more often in the shade. This indicated, according to the authors, that the horses preferred to be in the shade during hot sunny days (Holcomb et al., 2014). The preference for shade may vary depending on breed, and when both Arabians and draft horses were studied by Heleski & Murtazashvili (2010), Arabians sought shade less frequent than draft horses during hot sunny days. The authors also found that the shelters were used less than 10 % in many weather conditions but as much as 62 % when it was snowing and windy. According to the authors, the draft horses may have a higher need of shelter because of the docked tails and cannot perform tail switches efficiently to dislocate insects or maybe a difference in heat dissipation exists between the two types of horses.

Horses can maintain their heat balance and thereby constant body temperature within the thermo neutral zone, which is limited by the lower and upper critical temperatures. At the lower critical temperature (LCT) the heat production has to increase to maintain normal body temperature while at the upper critical temperature (UCT) the heat loss has to increase, especially by sweating (Sjaastad et al., 2010). The LCT is affected by several factors including body size, condition, age and feed quality (Cymbaluk, 1990). Different breeds are adapted to different climatic conditions. Northern breeds are often heavier build with thick coat and a body type adapted for energy conservation in comparison to southern breeds which are often more slender with fine coat and other physiological adaptions to aid heat dissipation (Goodwin, 2002). A study by Autio et al. (2006) observed different types of horses and their heat loss during different seasons and temperatures. The types of horses studied were light, warmblood, coldblood and ponies. All types of horses had the same heat loss at a temperature of 15°C and ponies had the same heat loss at 2°C and -12°C and were thereby less affected by colder temperatures than the other types of horses. The ponies also had the highest hair weight compared with the other horses.

The horses thermo neutral zone depends on the study and the horses involved. Horses acclimatized for the weather conditions have either a lower LCT or higher UCT than non-acclimatized individuals (McBride et al., 1985; Rammerstorfer et al., 2001). LCT may vary between -15°C (McBride et al., 1985) to 5°C (Morgan, 1998) depending on if the horses are acclimatized or not. Yearlings have a lower LCT when fed *ad libitum* in comparison with fed for moderate growth (Cymbaluk, 1990). The UCT is defined as the ambient temperature when the metabolic rate increases; when the evaporative heat loss increases or the tissue thermal insolence is minimal (Morgan, 1998). For horses, the UCT varies between 20 and 30°C depending on how the point is defined (Morgan, 1998).

2.6 Group dynamic

Feral horses live either in harem bands or bachelor bands. Harem bands are relatively stable and consist of one (or more) stallion and a group of mares and their offspring. Bachelor bands on the other hand consist of two to 16 individuals (McCort, 1984), especially young stallions but older stallions without own harams can also be a part of the band. These groups are relatively stable over time but less stable than harem bands (McCort, 1984).

Keiper & Receveur (1992) studied social interactions in two groups of Przewalski horses kept free-ranged. Younger horses showed less aggressive acts than older ones. In one of the groups they found a positive correlation between age and number of aggressive acts and in the other group it was also positive but not significant. Foals were involved in less agonistic interactions than horses of other ages, and foals and yearlings were also involved in most non-agonistic interactions. Heleski & Murtazashvili (2010) observed that foals are more willing to share shelter with each other than older horses. Studies have shown that social learning is improved by keeping an older horse among the young ones to show them how to behave (Kiley-Worthington, 2011). An older horse also gives confidence in new situations and places. Raising only youngsters together without any older horse may result in inappropriate behavior (Kiley-Worthington, 2011).

2.7 Human-Horse interactions

Contact with humans at a young age will influence the animals' reaction to humans. A study by Jezierski et al. (1999) compered heart rate and the easiness to handle young stock, either reared in a forest reserve or in stables and with or without handling by humans. The foals that had minimum contact with humans were handled just for routines or in case of emergency while the foals with human contact were handled for 10 minutes, five days a week. The observations were done during four occasions, at 6, 12, 18 and 24 months of age. Thirty foals of the breed Konik horse were included in the study and divided into the four different groups. The results showed that intensive handling by humans and rearing group had an effect on reaction and heart rate. The individuals reared in stables with human contact had the best handling score and lowest heart rate of the groups. The ones reared in the forest reserve and with human contact had better results than the ones reared in stables without contact with humans. Colts had a lower heat rate than fillies, but it was no significant difference in behavior reaction score. The heart rate was recorded during different occasions during handling, and the highest heart rate was achieved when the horses were captured in the paddock. Handling by humans results in higher learning capability and individuals that are easier to train compared to non-handled individuals (Heird et al., 1986). Horses that are raised without contact with humans have a larger flight distance than those raised with human contact and may become agitated and panic when humans approach in comparison to those raised with human contact (Fraser, 2011). Mazurek et al. (2011) examined if the outcome of the avoidance test on heifers was influenced by the dominant or the flightiest animal in the group. The dominant and flightiest animal was first identified and then an avoidance test was performed and the results show that the dominant and flightiest animal did not affect the test.

3. Material and Methods

3.1 Animals and enclosures

The study was carried out on twelve, one year old stallions of the breed Gotland ponies which had been purchased by SLU from different breeders in Sweden. The amount of handling prior to the start of the study varied between the horses but most of them were relatively unhandled.

The horses were divided into three groups with four individuals each, named group one, two and three. Individuals from the same breeder were separated and the horses were also divided according to rank and colour, so they would easily be recognized. The horses were checked every day and special attention was paid to signs of disease, injuries and lameness. The horses were also handled daily to habituate to human contact. The horses had halters in the beginning when they were hard to capture and two individuals in each group had a GPS collar around their neck for other studies during the project.

The enclosures were located in Krusenberg, south of Uppsala on SLU's property. The enclosures were 8-10 acres with about one third open field and two thirds of forest. The size of the enclosures was determined by estimating the feed intake over a year for four horses. Field number one and two had been grazed by cattle the last years, and field number three was harvested last year (2013). Horses had never been kept in those fields before and no other livestock had been kept in the forest before. Water was offered in automatic water troughs located in the forest and they had also access to water streams in the enclosures. In each enclosure, there was a shelter with roof and one open side. At the three first physical observations, the horses were observed in the enclosures and for the fourth time, a smaller area within the enclosure was fenced in so the horses could be studied on a smaller area.

3.2 Performance

This part of the project aimed to investigate some assessments related to animal welfare and a protocol was designed in line with WQ® (submitted Viksten et al.) including a human approach test and an avoidance distance test. Animal-based measures consisted of both physical and behavioural parameters. The behavioural observations were performed in the afternoon the day before the physical parameters were recorded so the horses would not be negatively affected by humans. The physical assessments were performed either in the morning or afternoon and the horses were caught and held on a lead rope by one person while another person was performing the assessment. The study was performed with start in the middle of May and continued until September 2014, and the horses were assessed every fourth week and during four occasions; observation one, two, three and four.

The first physical observation was done before the horses were divided into smaller groups and let out in the three separated enclosures. Because the behaviour observation should be done in the smaller groups, the behaviour observation could not be done the day before the first physical observation and was instead done one week later.

3.2.1 Physical parameters

The assessed physical parameters, their scale and description are shown in Table 1. All parameters were observed visually and by palpation. For lesions/wounds, skin problems and chafing, locations were noticed. Eventual wounds in mane/tail were excluded from lesions/wounds and assessed only in the mane/tail parameter. Skin problems included problems such as dandruff, crusts, dermatitis, sunburn and bites from insects.

Body condition score was assessed by palpation of certain areas of the horse, including ribs, hind quarters, neck, withers and behind the shoulders. The assessment was performed according to Carroll & Huntington (1988) and Wright et al. (1998) and the score reached from zero (very thin) to five (very fat) and included half points (Table 2). Half points are used if the back is assessed with one score and the neck and withers with another score.

Table 1. Physical parameters with their respective scoring scale and description

Physical parameters	Score	Description
Respiration	0	No abnormal flank movements
	1	Abnormal flank movements (deep or quick)
Thermal comfort	0	No indication of problem with handling temperature or weather
	1	Shaking from cold, panting, sweating, huddling
Lesions and wounds	0	No lesions or wounds that are worth mentioning
	1	Hairless patches without perforated skin
	2	Wounds where the skin is perforated <3 cm
	3	Wound larger than 3 cm
Mane and tail	0	No chafing or broken hairs
	1	Chafing in mane/tail, hairless patches, abnormal broken hairs (10 cm in mane or 5x5 cm in tail)
	2	Abnormal broken hairs or hairless patches in combination with perforated skin
Chafing	0	No indication of chafing
	1	Indication of chafing
Coat quality	0	Sleek, glossy coat
	1	Dull, dry coat
Skin problem	0	No indication of skin problem
	1	Indication of skin problem (dandruff, crusts, dermatitis, sunburn and bites from insects) on few spots of the body
	2	Large parts of the skin affected
Ocular discharge	0	No ocular discharge
	1	Dirty eyes with mucus in the corner of the eye
	2	Dirty eyes with or without mucus in the corner of the eye and eye discharge (1 cm long flow)
Nasal discharge	0	No indication of nasal discharge or transparent discharge
	1	Indication of nasal discharge (colored or thick) in at least one nostril
Hoof quality	0	No indication of hoof problems
	1	Some cracks or long hooves
	2	Severe cracking or hooves overgrown from natural shape
Lameness	0	No indication of lameness or abnormal movement
	1	Irregular, short movement.
	2	Lame, the horse will not put weight on one leg

Table 2. Description of the assessment of BCS, score 0-5 with half points (Adapted from Carrol & Huntington (1988) and Wright et al. (1998))

Score	Description
0 **Very thin**	**Neck:** Bone structure easily felt- no muscle shelf where neck meets shoulder **Withers:** Bone structure easily felt **Back & Loin:** 3 vertebrae easily felt points of **Ribs:** Each rib can be easily felt **Hind quarters:** Tailhead and hip bones projecting
1 **Thin**	**Neck:** Can feel bone structure- slight shelf where neck meets shoulder **Withers:** Can feel bone structure **Back & Loin:** Spinous process can be easily felt - transverse processes have slight fat covering **Ribs:** Slight fat covering, but can still be felt **Hind quarters:** Can feel hip bones
2 **Fair**	**Neck:** Fat covering over bone structure **Withers:** Fat deposits over withers - dependent on conformation **Back & Loin:** Fat over spinous processes **Ribs:** Can't see ribs, but ribs can still be felt **Hind quarters:** Hip bones covered with fat
3 **Good**	**Neck:** Neck flows smoothly into shoulder **Withers:** Neck rounds out withers **Back & Loin:** Back is level **Ribs:** Layer of fat over ribs **Hind quarters:** Can't feel hip bones
4 **Fat**	**Neck:** Fat deposited along neck **Withers:** Fat padded around withers **Back & Loin:** Positive crease along back **Ribs:** Fat spongy over and between ribs **Hind quarters:** Can't feel hip bones
5 **Very fat**	**Neck:** Bulging fat **Withers:** Bulging fat **Back & Loin:** Deep positive crease **Ribs:** Pockets of fat **Hind quarters:** Pockets of fat

3.2.2 Behavioural parameters

The behaviour of the horses was assessed to determine if their behaviour changed over time and if they become more fearful to humans. This assessment was done by a human approach test and an avoidance distance test which includes easiness to approach and touch the horses as well as their reaction when approached. The general impression was noted as well as how horses of the group interacted with each other and which horse was the highest in rank and if someone was excluded from the group.

In the human approach test, the observer walked towards the group of horses and the reaction from the horses was noted (Table 3). The human approach was directed towards the group of horses and individual behaviour was observed and assessed. The horses were approached by

the person in a normal gait and the horses were aware of the person approaching from at least 20 meters. The horses' reactions were recorded when the assessor was five meters away from the group. Thereafter, the avoidance distance test was performed instantly.

The avoidance distance test was carried out immediately after the human approach test where the ability to touch the muzzle was checked or if the individuals were trying to avoid the touch. The horse closest to the assessor was the first to be approached and thereafter the other individuals were approached one by one. The test started approximately four meters from the individual horse, which was approached in normal gait and always with one hand stretched out and closest to the horse (Table 3). If the horses came walking towards the observer, recordings were made when each horse came close, and the assessment was done in the same order as horses approached.

Table 3. Behaviour parameters with respective score and description

Behaviour parameter	Score	Description
Human approach test	0	Positive, the horse move towards/turn its head or reach out for the person
	1	Neutral, no distinct movement against the person or only turn an ear without turning its head
	2	Aggression or avoidance, aggressive behaviour as ear flattening, bites or more threatening behaviour or avoidance by moving away
Avoidance distance test	0	Possible to touch the horse
	1	Closer than 50 cm but not possible to touch
	2	Between 50 and 100 cm before the horse turns away
	3	Not possible to come closer than 100 cm

3.2.3 Resource-based parameters

Resource-based measures, as access to water in the trough and the cleanliness of the water in the trough were observed and assessed (Table 4) at the same time as the physical parameters. In addition, weather (e.g. sunshine, cloudy), ambient temperature and time of the day were recorded.

Table 4. Rsource-based measures with their respective scoring and description

Resource-based measures	Score	Description
Water access	0	Access to water
	1	No access to water
Water cleanliness	0	Clean, both water and bowl clean
	1	Partly dirty, water clean and fresh but bowl dirty
	2	Dirty, both water and bowl dirty

3.2.4 Statistical analyses

Body condition score was analysed with SAS statistical package (SAS Inst. Inc., Cary, NC) using a repeated mixed model (PROC MIXED) to analyse if observation, group or

observation*group had any effect on the result. Least square means were then calculated and t-values were used to investigate if there were any differences within the groups or between observations.

The physical and behavioural parameters were analysed according to observation and group and expressed in proportion to the total number of observations using 2 Proportions test performed in Minitab. The p-value for Fisher's exact test was used due to small samples. The four observations were analysed separately and then the two first observations were combined and compared with the two last observations. Groups were analysed and compared to evaluate if there was any difference between the groups from the first observation to the last.

4. Results

4.1 Physical parameters

Time had a significant (P<0.001) effect on BCS and all individuals either increased or maintained their BCS from the first observation to the last. The mean value of the BCS when all groups were observed as one group increased from 2.76 at the first observation to 3.38 at the fourth observation. Significant differences were seen between the first observation and the third (P<0.01), the first observation and the fourth (P<0.01) as well as between the second observation and the third (P<0.001), and the second observation and the fourth (P<0.001) (Figure 1). Between the first and the second observation two of the individuals did lower their BCS and the remaining ten horses maintained the same BCS. No significant difference was seen between the first and the second observation and the third observation compared with the fourth (Figure 2). Observation*Group had no significant effect but if the mean values were compared, differences could be seen between the second observation and the third, and the second observation and the fourth in all groups (P<0.01). A tendency to lower BCS were seen in the horses in group 1 which had the lowest mean BCS during all observations, but the result was not significant.

Twelve horses should be assessed four times. However, at the first observation three horses could not be captured (later placed in group 1, 3 and 3) and only a visual assessment was done on those individuals. At the second observation it was two individuals (group 3) and at the third observation it was one individual (group 3) that could not be captured and assessed by palpation. In the statistics these scores are marked as missing values.

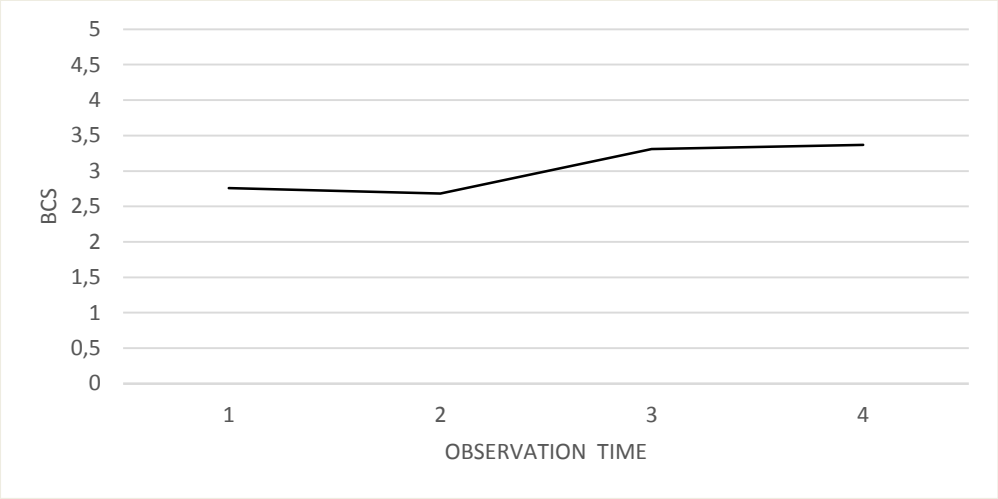

Figure 1. Mean BCS for the different observations when all horses were assessed as one group.

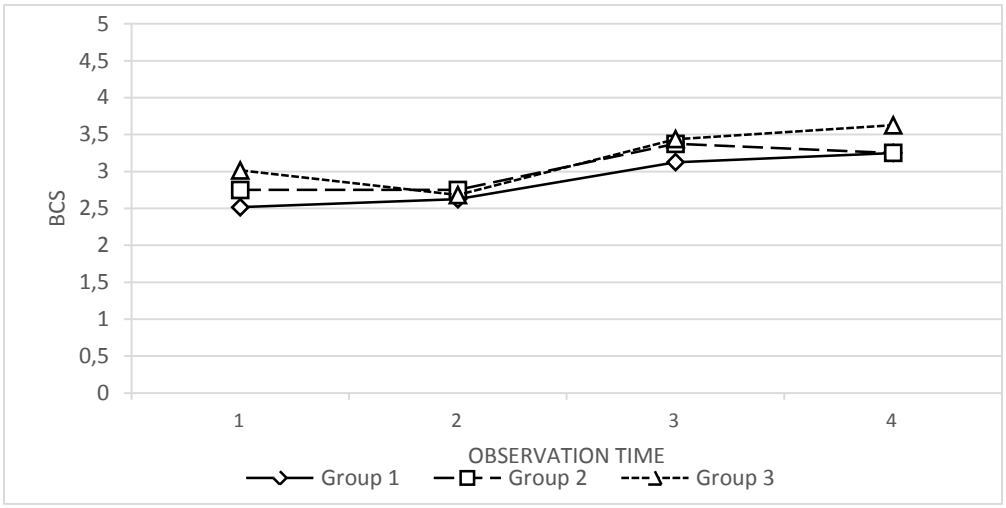

Figure 2. Mean value for each observation and each group

The mean presence over time for all physical parameters is shown in Table 5 and Table 6. The presence of lesions and wounds had a tendency to decrease by time when the two first observations were compared with the latter ones, with a significant ($P<0.05$) decrease between the second observation and the third. At the two first observations 46 % of the horses were observed with wounds which decreased to 17 % in the later observations. Also number of wounds scored as one or higher decreased by time between the second and third observation ($P<0.05$). No differences were seen between the groups. Some wounds with less than 3 cm perforated skin appeared (score 2) but no larger wounds were detected.

Broken hairs in mane and tail as a result of rubbing, increased by time ($P<0.001$) when the two first observations were compared with the latter observations, with the most broken hairs observed at the last observation. Score 2 was not observed throughout the study, since the skin in the mane or tail was never perforated. No significant differences were seen in the presence of chafing over time or between the groups.

Coat quality was significantly improved during the spring and summer as a result of shedding the winter coat ($P<0.001$). Significant differences were seen between the second observation and the third respective the fourth ($P<0.001$) with no differences between the groups. The number of skin problems increased by time ($P<0.01$) when the two first observations were compared with the two last. The horses in group 3 had a tendency to be less affected by skin problems than the other groups, but the result was not significant. No severe skin problems assessed as score 2 were observed.

There were no significant differences over time for ocular discharges when both first observations were compared with the last two observations. However, there were more ocular discharges assessed at the fourth observation compared with the other observations. There were no significant differences between the groups. No differences were seen in nasal discharge when the two first observations were compared with the two last. Hoof quality was significantly affected by time ($P<0.05$) and number of long hooves or hooves with cracks increased, but no severe hoof health problems were seen.

Physical parameters as respiration, problem with thermal comfort and lameness were not observed throughout the study in any of the individuals.

Table 1. The table illustrates the percentage of prevalence for the physical parameters when all individuals are assessed as one group. Lesions/Wounds could be assessed with score 3, but since it was not observed the result is not presented.

	Observation and score							
	1		2		3		4	
	1	2	1	2	1	2	1	2
Lesions/Wounds	25	8	42	17	0	8	25	0
Mane/Tail	0	0	17	0	50	0	92	0
Chafing	42	*	50	*	67	*	50	*
Coat quality	100	*	67	*	0	*	0	*
Skin problem	0	0	25	0	42	0	58	0
Nasal discharge	0	*	8	*	0	*	25	*
Ocular discharge	8	17	8	8	8	17	42	0
Hoof health	0	0	0	0	17	0	33	0

*-indicate no possible score for the parameter (parameters are assessed 0-1)

Table 2. The table illustrates the percentage of prevalence for the physical parameters when all individuals are assessed as one group. Observation 1 and 2 is assessed as one group and observation 2 and 3 as one group. Lesions/Wound could be assessed with a score 3, but since it was not observed the result is not presented as an alternative.

	Observation and score			
	1 and 2		3 and 4	
	1	2	1	2
Lesions/Wounds	33	13	13	4
Mane/Tail	8	0	71	0
Chafing	46	*	42	*
Coat quality	42	*	0	*
Skin problem	13	0	50	0
Nasal discharge	4	*	13	*
Ocular discharge	8	13	25	8
Hoof Health	0	0	25	0

*-indicate no possible score for the parameter (parameters are assessed 0-1)

4.2 Behavioral parameters

In the human approach test there were no significant differences over time. All horses approached or showed interest in the person during the first and the last observation. The horses showed less interest at the third observation compared with the first and fourth ($P<0.05$). Except from the third observation it was more common with a positive behaviour when approached than neutral but the result was not significant. One horse was assessed with score 2 during the second observation, which had no significant effect on the result. During the second observation, the horses in group 2 were all ignoring the approach which differed from the other groups as well as subsequent observations in the same group. Group 3 showed the same pattern at the third observation ($P<0.05$). In total, a positive behaviour towards people was seen in 75 % of the observations.

In the avoidance distance test, there were no significant differences from the first observation to the last and there were no differences between the groups. Avoidance was only seen three times and then in group 2 at observation one, two and four. One horse was assessed with score 1 and two with score 3. In total, avoidance was seen in 6 % of the observations.

With time, all individuals became easier to handle but it did take different amounts of time for the different individuals. Of The nine horses that could be captured and handled at the first observation, only some were calm and curious, most of the horses got stressed, wanted to get away or were sceptical towards humans. By time the horses were more positive towards humans and at the last observation it was only one individual that still was sceptical. The group dynamic seemed to work fine; the hierarchy was mostly hard to notice, except when treat was offered as a reward. In that case individuals with higher rank could be identified.

4.3 Resource-based parameters

In all enclosure the horses had access to water throughout the study. There were no significant differences over time or between the groups. The water was assessed as dirty at the second and third observation in group 1 and 2. The first observation is not included in the calculation since the horses were kept together in the same enclosure and used the same trough.

5. Discussion

5.1 Physical parameters

Soon after the arrival to the project site and at the first time of observation, six of the horses were slightly thin and scored 2-2,5 on the body condition scale. However, at the last observation the horses body mass had increased and their BCS were equivalent to all other individuals. The horses either increased or maintained their BCS during the study. The increase or the maintenance of the BCS was probably due to a high nutritional state of the pasture in comparison to what they earlier were offered. In the last two observations no thin individuals were observed and the BCS varied between moderate (3) and moderate fat (3.5). The increase in BCS was expected, since the area of the enclosures was based on the calculated yearly feed intake for four horses.

The prerequisite in terms of pasture quality varied between the groups since the third enclosure produced almost four times more growth mass than the other two enclosures (observed by other studies). In the two remaining enclosures, no significant differences in the growth could be seen. As a possible consequence, the horses in group three had a tendency to have the highest BCS mean in three of four observations and a higher total BCS mean. The third enclosure had been harvested the year before whilst the other two had been grazed by cattle. Probably this different treatment can explain the alteration in the three groups. The growth mass at the pastures may not have any importance during spring and summer, but can be essential during fall and winter as the study proceeds. Since the horses will be kept on their pasture over the winter without any supplementary feed a weight gain during spring and summer is necessary for building and storing extra layers of fat that can be a major asset in wintertime when access to feed is limited (Gudmundsson & Dyrmundsson, 1994).

In this study an increase in BCS could be expected at individual level from the start due to pastures of high nutritional value, especially in the ones with lower BCS. Instead the BCS either decreased or the horses kept the same body score between the first and the second observation. This result might be explained by the release to new and unknown pastures and introduction to strangers and some kind of explorative phase may have occurred. In a study of recently released Przewalski horses the authors expected the horses to go through different phases including an explorative phase where the horses would have a high activity of movements spending less time grazing (Souris et al., 2007). The horses in this study had a higher BCS mean than horses in a study conducted by Hampson et al. (2011) on feral horses

where some of them grazed on poor pastures. Although the results of our horses' body score were equivalent to the ones grazing on the better pastures in the study of Hampson et al. (2011). In the study of Mullan et al. (2014) the third most common welfare problem were thin horses, which was not the problem in this study. It should be mentioned that no animals had been grazing on these pastures since last summer and another result may be expected during the coming years when the horses had been on the same pasture for a longer time.

At the first observation, three horses refused to be captured and palpated for BCS and only a visual observation could be performed on these individuals. At the second observation, two horses could not be captured and the third time, one horse refused and visual observation was performed. In group three, there were two individuals that refused to be captured and palpated for as much as five times in total. One of them had probably the highest BCS, according to the visual assessment and the other one in the same group was one of the thinnest. In group one, there was another horse that could not be caught and investigated and it was also one of the thinnest individuals similar to the horse in group three. However, these individuals did not influence the outcome of the data. When the missing values had been replaced by the score of the visual assessments in the statistical calculation, no differences in results were detected.

Presence of lesions and wounds decreased from the first observation to the last. This may be a result of a reduction of aggressive behavior while the hierarchy is being established within groups. All twelve horses were at the first observation in the same enclosure, and most pronounced were scratches on the inner legs which probably were related to fights or to play. The general impression was that the horses were fighting more in the beginning, when all twelve were grouped together. The same horses were observed at all occasions and therefore some lesions were assessed twice since they had not healed since the last observation. At the fourth observation, the number of lesions had increased slightly in group three, they were located on the inside of the legs which leads to the assumption that they derived from playing or fighting. The result is in agreement with Kane (2011) who is of the opinion that lesions and wounds seldom occur among feral horses.

At the first and the second observation when most of the horses were hard to capture they had halters, which resulted in a lot of chafings on the head. At the same occasions they still had much winter coat and thereby it was more likely to get chafing. Except from one case, it did not develop into wounds. In a study of Mullan et al. (2014) they examined if head collar material had an effect on the prevalence of wounds, but they saw no difference between webbing, rope or leather. There were no differences over time in presence of chafing, but the chafing from halters disappeared when the horses no longer needed halters. Instead, the chafing from the GPS collar increased and all horses wearing this got affected and these chafing did not heal as fast as the chafing from the halters. To minimize and reduce the presence of chafing caused by the GPS collar, they were moved around among the horses and wrapped to become softer. Horses in group three had slightly more chafing than seen in the horses in group two, probably because there were individuals that wore halters for a longer time. For the study, an alternative to wearing GPS collar around the neck would be a GPS chip that is inserted subcutaneously, but according to the horses' reaction towards humans in the beginning of the study it does not seem to be a good idea. If the horses had been kept by farmers on extensive pastures they probably would not have carried GPS collars and this can therefore not be considered as an expected welfare problem under normal circumstances. However, it is possible that the horses would carry some kind of GPS to simplify the daily control of the horses. The GPS collars could in that case reduce animal welfare according to the result of this study and eventually an insertion of a chip would be better from an animal

welfare point of view. The use of halters on common farmer extensive pastures may vary between farmers, but if halters are used it may result in severe animal welfare problems such as severe chafing and injuries caused, for example, by a foot getting caught in the halter.

At the first observation, the coat of all horses was dull and shabby, because they were about to shed their winter coat. At the second time of observation, some of the horses had a nice coat but several still had the winter coat left. At the third time, they had all been shed and had fine coats and there could not be noted any difference in the quality of the coats. Skin problems increased with time, but no severe problems (score 2) were observed. The horses in group three had a tendency to fewer problems than the others groups. At the second observation, some individuals were sunburnt on the muzzle, and in later observations mainly bites from insects and ticks were seen. The parameter skin problem also included dandruff, crusts and dermatitis, but they were never observed during the study. In contrast to the study done by Samuel et al. (2012), no prevalence of rainscalds were seen, which could be explained by the horses' access to shelter from rain as well as it was ordinary very dry summer so the horses were not exposed to much dampness. In the Samuel et al. (2012) study the prevalence of rainscald, where the horses did not have access to shelter, varied on a weekly basis, depending on weather.

The presence of broken hairs in manes and tails increased in all three groups which could be a result of abundant insect pressure and thereby increased itchiness. The prevalence of eye discharge did not differ between the observations. However, the prevalence was a bit higher in group one and two compared with group three, altough the result was not significant. The amount of discharge from the nostril increased in group one and two as the study proceeded. The horses in group three had no problems with nostril discharge.

The location of the pastures may have had an effect on the welfare and result. Enclosure one and two were placed next to each other and it was also these horses that had the highest frequency of eye discharge and skin problems throughout the study. Skin and eye problems may be an effect of insects (Greiner, 1995) which irritate eyes and bite. According to the higher frequency of eye discharge and skin problems in enclosure one and two, it can be assumed that it was higher insect pressure than in enclosure three. A study by Gorecka & Jezierski (2007) has shown that horses receive fewer bites in open spaces or higher slopes where the velocity of wind is higher and also in spaces with lower temperature. The location of enclosure three was perceived as more open and thereby a possibility to lower insect pressure. The higher prevalence of nostril discharge in enclosure one and two may be the result of infectious contamination of some kind and those enclosures may be affected since they were located next to each other. The horses were checked for Streptococcus equie, but were diagnosed negative.

During the time of study some of the horses got a little too long hooves or hooves with cracks but no severe problems was observed. Abnormal respiration, problem with thermal comfort or lameness was not recorded during the study. Higher respiration rate may occur in combination with injuries, wounds, stress or when the horses cannot cope with high temperature (Holcomb et al., 2013). The horses acclimatized to the temperatures and handled it, although it was an unusual hot sunny summer. The physical assessment was mostly performed in the morning and the horses were calm during the assessment.

5.2 Behavioral parameters

All horses got increasingly easier to handle during the study. This pattern is probably due to the daily handling of the horses to facilitate the physical measurements. One of the hypotheses of the study was that the horses should get harder to handle and more feral, due to less interaction with humans but then the daily handling was not considered. The horses were handled daily, but the time it took for individuals to trust humans varied, and one horse was impossible to touch on the entire body during the study until the last observation. Still in August, that individual could not be captured and equipped with a halter. More studies are needed to investigate if horses would become harder to handle if let out without daily handling. The horses that were most easy to handle in the start were most easy to handle in the end of the study, but the individuals that were hard to handle got easier by time.

The experience based on the assessor is that the horses in group one and three were gathered in groups of four at most of the observation time, whilst the horses in group two often were separated two and two or stood alone. This observation in group one and three may indicate a better group dynamic. One individual in group two showed some aggressive/avoiding behavior but in the same group, two individuals showed the most social and nice behaviors towards humans. The reaction changed in the groups when feed was presented, some individuals acted bossier, but apart from that nothing can be said about hierarchy.

The human approach test showed in the beginning that the horses were interested in humans and either came forwards or lifted/turned the head towards the observer. By time the interest decreased, although not significant, and the horses were more interested in grazing. At some points the horses were more interested in grazing and showed no interest in humans, which happened once for the horses in group one and three, respectively. Only one individual in group two showed a slightly aggressive and avoidance behavior towards humans, that behavior had no significant statistical effect on the outcome of test. This individual had an earlier negative experience with humans when the GPS collar got stuck over the ears. In some occasions the horses walked towards the observer during the human approach test and the avoidance distance test and in these cases it was noticed in which order they approached. This was done in order to, if possible, identify the bossiest horse and hierarchy. However, the horses approached in different orders at all observations.

Throughout the study it was unusual that the horses were avoiding people. Only three patterns of avoidances were recorded, all in group two, and in that group, one individual demonstrated avoidance at two occasions. However, in the statistical analysis no significant differences were seen over time or between the groups. The individual that showed avoidance towards people in the avoidance distance test was also the one that showed aggressive/avoiding behavior in the human approach test. The horses that refused to be captured for the physical assessments, all scored 0 in the avoidance distance test and thereby it was no difficulties to touch them on the muzzle. These horses followed the other ones when they approached humans and sometimes they came first in the line, even if it was not possible to capture them.

The avoidance distance test was performed to notice how close to the horses it was possible to come and if it was possible to touch the horses. Since it is important from an animal welfare point of view that the horses can be handled it is necessary that humans are able to touch them. In this study, the test was based on the possibility to touch the horses' muzzle and almost all horses scored 0 (possible to touch). However, as mentioned there were some individuals that could not be captured for the physical tests and to identify these horses in this test, the test could be performed in a different way in a future study. It was noticed that in

some cases it was possible to touch the muzzle but the horses retreated if the person tried to touch their neck or body. According to this, the test could be performed firstly by touching the muzzle and if that is possible touching the neck or body. Some horses would then probably be scored as avoiding and the horses that could not be captured would be identified even in this test. However, according to the result of Mazurek et al. (2011) the most dominant or flightiest individuals do not affect the avoidance distance test.

5.3 General parameters

The horses had access to water by automatic water troughs throughout the study. The hygiene of the water was a problem which may depend on the automatic. By using manual troughs the amount of water has to be controlled daily and thereby also the cleanliness of the trough and the water. It may also be easier to clean the manual troughs when they are not filled with water in comparison with the automatic trough which are always full. If automatic troughs still should be used, it is a good idea to place them close to the road or the opening of the enclosure so they could easily be controlled.

The behavior observations were done in the afternoon for the whole period, at temperatures of 16 – 23 °C, in either cloudy or sunny weather. The physical parameters were assessed in either the morning or afternoon at a temperature of 15 – 25 °C in either cloudy or sunny weather. According to the personal experience of the assessor; weather, time or temperature did not affect the horses and consequently not the outcome of the study.

5.4 Welfare Aspects

All horses had been kept together in one enclosure the first month before the project started. When the horses were divided into the three different groups, two of the horses could not be caught and transferred to the two enclosures located a short distance from the first. These two individuals were therefore kept together in the enclosure located nearby the first enclosure. Keeping two horses hard to handle in the same group, give reason to believe that it took them a longer time to get used to humans, and can have an effect on the result.

The horses were purchased from different breeders and their prerequisite in terms of handling by humans varied; some of them were more handled and some less. This resulted in, especially in the beginning, differences in their response to human contact. The horses were handled daily to get used to humans and they gradually got easier to handle, with less visible difference between the individuals. The differences in behavior were mainly seen in the general impression and not shown in the human approach test or avoidance distance test. However, if the horses instead would be let out on common farmers pastures and only controlled daily for injuries and sickness, the differences in behavior had probably increased and resulted in more feral horses.

Although the horses were handled daily, it took rather a long time for especially one individual to trust humans. The event indicates the importance of selecting individuals that are well-managed and tamed from the beginning to be kept extensively. According to this study, some welfare problems were seen as wounds (59 % during observation 2), chafing (67 % during observation 3), ocular discharge (42 % during observation 4), skin problems (48 % during observation 4) and chafing in mane/tail (92 % during observation 4). Similar results, as seen in this study, were presented by Mullan et al. (2014) who observed tangles in mane and tail as the most common problems and even if this was not seen as a real welfare problem it looked bad for the public. The second most common problem in their study was eye

discharge, seen in 28,7 % of the observations. To reveal problems and in addition be able to treat them, handling of the animals is important and regulated by the Swedish Animal Welfare Act (SFS 1988:534): "*Animals should be treated well and be protected against suffering and illness*". To achieve and maintain animal welfare according to the Swedish Animal Welfare Act it is therefore important that the horses can be approached and handled. This is perhaps especially important during the winter when the coat is thick and the horses may look fatter than they are. Some of the assessed parameters can be performed visually the year around, as respiration, eye- and nostril discharge as well as lameness and some parameters could easier be performed when the horses wearing summer coat as lesions and skin problems. To assess BCS it is necessary to handle and palpate the horses and only a visual assessment is not enough. By a visual assessment it is possible to see if the horses are thin or fat but it is not possible to decide if it is muscles or fat underneath the skin. In this study the horses still had their winter coat during the first two occasions, which hampered the possibility to a correct visual scoring for some of the parameters. As mentioned, during spring and summer, it may be possible to assess welfare visually but when the coat becomes thicker during fall and winter, the more difficult it becomes to do the visual assessment.

In this study, the hoves were trimmed before the horses were released to the pastures. Some of the horses were although later observed with a bit too long hooves and some of the hooves were seen with smaller cracks. The results here were in agreement with the study of Samuel et al. (2012). Compared with the results here the prevalence of their observations of problems were higher with an hoof overgrowth in 33 % and hoof cracks in 40 %. According to the Swedish Board of Agricultural´s regulation (DFS 2007:6 L 101): "*The hooves shall be controlled regularly and trimmed when necessary*". Concerning the regulation it could be a violation of the animal welfare regulation if the hooves cannot be trimmed. Horses that are not docile and tamed will be difficult to handle, hard to capture and all treatment will be stressful, as for example to be trimmed by a blacksmith and in case of emergency treated by veterinarians as well as be transported.

There are a couple of regulations about feed and water to horses. According to the Swedish Animal Welfare Act (SFS 1998:534): "*The feed should be adapted for the species and the amount of feed should be sufficient*". The Swedish Board of Agriculture´s regulation (DFS 2007:6 L 101) states: "*The feed should give the horses enough fiber and occupation and the feed shall enable the horses to keep a normal body condition*". Horses are good grazers, they can utilize pasture with high amount of fiber and unequal energy quality. It gives them the possibility to graze multiple plants and on various pastures. During spring and summer, when this study was performed the amount of feed was sufficient and the pasture gave the horses enough fiber and therefore sufficient occupation. The problem to meet up to the intentions of the legislation would occur during fall and winter when there is no growth of grass and herbage. The Swedish Board of Agricultural´s regulations (DFS 2007:6 L 101) also state: "*The horses need for long eating time should be met*". This regulation is easy to fullfill on pastures. However, during the time when the grass grows execcively and the horses have access to large areas the risk for overweight increases. Obese horses were not seen in this study, the horses kept a moderate body score. On the other hand, the horses need to put on some extra layers of fat before the winter, when access to feed is limited.

In the legislation (DFS 2007:6 L 101) it is written that: "*Horses kept outdoors the year around should be adapted to the circumstances*". As the horses in this study are kept outside the year around they have the possibility to acclimatize to hot as well as cold weather, which gives them a wider thermo neutral zone than non-acclimatized individuals. The thermo neutral

zone of horses depends on factors such as the animals' age, breed and condition (Cymbaluk, 1990) and to what temperature the individual breed is acclimatized (McBride et al., 1985; Morgan, 1998). The Swedish regulation (DFS 2007:6 L 101) and the Swedish Animal Welfare Act (SFS 1998:534) follows up with: "*Horses kept outdoors shall also have access to shelter for protection from weather and wind during harsh climate and the shelter shall provide enough space and offer protection*". Holcomb et al. (2013) claims that it is important for horses to have access to shaded areas during hot weather, because horses exposed to the sun during hot and sunny days without access to shade may suffer from higher rectal temperature, higher skin temperature, higher respiration rate and more sweating. Horses also spend more time than expected by chance in the shade during hot weather (Holcomb et al., 2014). At time for the assessments the horses in group two were often seen close to, or inside the shelter which may be a way to get shade and it might be less insects than in the forest. The horses in group three had a grove close to the shelter and were often seen around this area. The shelter was located on the fields and if the horses were not observed close to the shelter they often dwelt in the open fields at time for the assessments. The frequency of insects could be assumed as high during the study and the horses probably preferred areas with less insect harassment, as areas with sparse vegetation and with higher wind velocity (Keiper & Berger, 1982).

In the Swedish regulation (DFS 2007:6 L 101) it is written:"*Horses shall be kept in order to minimize the risk of severe bites from parasites during summer*". This can be done by the location of the pastures to enhance the wind velocity, keeping horses together or by access to shelter. The horses in this study had some bites from insects but this was not assessed by the observer as a severe problem. The horses were also kept together, although keeping four horses together may not be as efficient as keeping 10 horses together in terms of insect harassment. The horses had also access to shelter and open field with higher wind velocity. As mentioned, shelter for horses kept outdoors is only needed, according to the Swedish legislation, during the cold season but not in summertime, when shelter might be needed even more. Samuel et al. (2012) observed rainscald in 37 % of the observations varying on a weekly basis and up to 82 %, depending on the weather. Since rainscald is linked to prolonged wetting of the coat and may be painful to the individual (Pilsworth & Knottenbelt, 2007) shelter should be provided and it is important that horses can seek shelter from rain, especially in summertime.

Goodwin (2002) points out that different breed of horses are adapted to different climate and weather conditions. Northern breeds are more suitable for the Swedish climate due to their body type and physiology than southern breeds which are adapted to a warmer and dryer weather. Autio et al. (2006) showed that different types of horses had the same heat loss at 15°C and that horses with thicker coat performed better in colder climate than the other types. According to Autio et al. (2006), the differences between breeds in heat loss are smaller during spring and summer than during harsher climate. In this study, the temperatures were higher than the measured temperature by Autio et al. (2006) but no tendency of heat problems could be seen among the horses and it can be assumed that the horses handle heat well. Heleski & Murtazashvili (2010) indicate another difference between types of horses which was that draft horses preferred shade more than Arabians. According to the result of Autio et al. (2006) and Heleski & Murtazashvili (2010) it can be assumed that the choice of breed is less important during spring and summer and more important during harsh climate. The Gotland pony was in this case, chosen because of its adaption to the Nordic climate (Erixon, 2012) and because it is an endangered breed and worth to be preserved (FAO, 2007; Swedish

Board of Agriculture, 2007). Using Gotland ponies as conservationists could be a new niche for the breed and it is probably a breed well-suited for the task.
The choice of individuals that are most suitable for this kind of pasture can be discussed and it is really important to select suitable individuals of horses to be held in an extensive manner. There are a couple of factors that play an important role such as breed, sex and age of the horses as well as location of the pasture. The horses shall be kept with maintained animal welfare and be adapted to the climate. According to Autio et al. (2006), ponies have a lower heat loss in comparison with other types of horses and this indicates that Gotland ponies, as used in this case, may be a good choice of breed. It is a Swedish indigenous breed used to the weather conditions and at the same time a breed with low body weight that does not harm the ground as much as heavier breeds.

To introduce and keep young horses as conservationists, as in this case ($\leq$ 1 year of age), can be discussed. According to Keiper & Receveur (1992) foals are less involved in aggressive interactions than older horses and show more non-agonistic behaviors. However, in a flock of horses yearlings are more exposed to aggressiveness than horses of other ages but they deliver few aggressive behaviors. This is true in a group of horses were all ages are present and where the older horses have a higher rank. The status of the hierarchy is established among horses at the time they are introduced to each other, with an obvious risk for injuries, which can be countered if the horses are introduced as young individuals before puberty. Horses on extensive pastures may not be handled on a daily basis except from a visual daily control. In case of sickness and control of the hoof status it is therefore important that the horses have trust in humans and can be caught. By using older horses on the pastures it is possible they keep their trust to humans and are easier controlled since they had been handled by humans for longer time.

This study indicates that during spring and summer, young horses and probably also older horses perform well and grow, but as the study proceeds it will reveal how horses cope with harsher climate. It is known that old horses may have special demands when it comes to feeding due to impaired teeth and digestion (Ralston, 1984). Weight loss is a common problem for old horses and they may not do well with the limited amount of feed (Pagan, 2011).

Beside breed and age, sex can also be of importance. Studies indicate that stallions have the ability to store more fat, which is expressed as one to three points' higher BCS than mares have (Rudman & Keiper, 1991; Hampson et al., 2011). The scientists discuss that the result of thinner mares depends on the extra energy she needs to dispose to raise a foal. Rudman & Keiper (1991) have come to the conclusion that non-lactating mares have better body scores than lactating mares; consequently non–lactating mares can be kept on extensive pastures while lactating animals should be avoided. The mares on Lojsta have foals during spring and summer and foals are separated from their mothers in November the same year which may give the mare a better chance to increase the body condition before winter. The remaining mares and some yearlings are additionally fed with hay every second day during the winter month. In this study, stallions were used but in normal animal husbandry keeping stallions together is often avoided because of aggressive behavior. On the contrary feral horses often live in bachelor bands if they are not a part of a harem. Those bachelor bands are relative stable and stallions have been seen to live together for long times (McCort, 1984) and if the pastures are large enough there should not be any problems by keeping stallions together.
In nature reserves or pastures close to the city, the location of the pastures may influence the choice of age and sex of horses. From that point of view, where strangers might enter the

pastures, the horses' age and sex have to be considered. Stallions represent a higher risk for visitors than geldings and mares. Enclosures with stallions should only be entered by people who understand the risk and behavior of stallions. The entry of young people can also do the horses extra hazardous by the horses' playfulness and unpredictable and may lower the security for humans. However, at pastures were strangers may not enter; young animals as well as stallions can be a choice.

The impact of time span seemed to have an effect of the assessed parameters and either an increase or decrease of the animal welfare was observed. No severe problems were detected. The changes over time that were observed are probably natural explained and depend on factors that are hard to avoid. The insect pressure is higher during summer than the rest of the year, whereof the prevalence of skin problems and chafing in mane/tail may increase and even eye discharges. Chafing from halter and GPS collar could be avoided by not using it but for the study the use of GPS was necessary and a halter was needed to capture the horses in the beginning. The coat of the horses was dull at the first observations but as the horses changed coat the coat quality was improved.

According to the Swedish Animal Welfare Act (SFS 1988:534) and the Swedish regulation (DFS 2007:6 L 101): "*Animals shall be kept in an environment that promotes their health and give them opportunity to behave natural and their social need shall be met*". Keeping horses as free-ranged is the the most adequate way to meet their need for expressing natural behaviour and to live as their wild ancestor and met up the intention of the regulations.

No comparison was done between horses kept conventionally and horses kept on extensive pasture. Presumably, no differences should have been seen during the spring-summer period. Lots of studies have been made on behavior (McCort, 1984; Keiper & Receveur, 1992; Jezierski et al., 1999; Heleski & Murtazashvili, 2010) and BCS (Rudman & Keiper, 1991; Souris et al., 2007; Hampson et al., 2011, Samuel et al., 2012) on feral and free-ranged horses, but there is a lack of studies observing welfare parameters. More studies are needed to examine and compare conventional held horses with horses on extensive pastures and the animal welfare of the horses in each system.

6. Conclusion

The Gotland ponies can manage on extensive pastures with maintained good animal welfare during late spring and summer. The time span had a significant effect for most of the physical parameters and BCS. Broken hairs in mane and tail as well as skin problems increased by time, BCS increased and the coat quality improved. All individuals became easier to handle. The horses had no problems with the thermal comfort, respiration or lameness. As the horses had no problem with the thermal comfort or severe skin problems indicates that the horses could seek shelter from insects as well as the sun. According to the animal welfare protocol no severe welfare problems could be observed during the period which indicates that the horses can manage with maintained animal welfare. Further studies have to be carried to study the animal welfare under harsh climate.

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