Vitenskapskomiteen for mattrygghet
Norwegian Scientific Committee for Food Safety

VKM Report 2017: 8

Risk of negative effects on the welfare of dogs associated with being housed outdoors or used for sled dog racing

Opinion of the Panel on Animal Health and Welfare of the Norwegian Scientific Committee for Food Safety

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Norwegian Scientific Committee for Food Safety (VKM)
Po 4404 Nydalen
N – 0403 Oslo
Norway

Phone: +47 21 62 28 00
Email: vkm@vkm.no

www.vkm.no
www.english.vkm.no

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Authors preparing the draft opinion

Knut Egil Bøe (chair), Cecilie Marie Mejdell, Ellen Skancke, Judit Banfine Vas, Angelika Agdestein (VKM staff), Dean Basic (VKM staff)

(Authors in alphabetical order after chair of the working group)

Assessed and approved

The opinion has been assessed and approved by the Panel on Animal Health and Welfare. Members of the panel are: Brit Hjeltnes (chair), Øivind Bergh, Edgar Brun, Knut Egil Bøe, Carlos Goncalo Afonso Rolhas Fernandes das Neves, Jacques Godfroid, Roar Gudding, Kristian Hoel, Cecilie Marie Mejdell, Stein Mortensen, and Espen Rimstad

(Panel members in alphabetical order after chair of the panel)

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Competence of VKM experts

Persons working for VKM, either as appointed members of the Committee or as external experts, do this by virtue of their scientific expertise, not as representatives for their employers or third party interests. The Civil Services Act instructions on legal competence apply for all work prepared by VKM.

Table of Contents

Summary

The Norwegian Food Safety Authority (NFSA) asked the Norwegian Scientific Committee for Food Safety (VKM) for an opinion regarding the risk of reduced animal welfare, associated with dogs kept permanently outdoors and dogs that are used for long-distance sled dog racing in Norway. The risk assessment will be used by NFSA as a scientific framework for updating "Guidelines for outdoor housing of dogs" from 2003, and compliance with the present Animal Welfare Act. This information is intended to provide a more solid scientific basis for ensuring animal welfare, better guidance for both owners and race veterinarians, and to improve existing regulations in sled dog racing.

A working group was established comprising members from the Panel on Animal Health and Welfare and external experts from the Norwegian University of Life Sciences. The Panel on Animal Health and Welfare has reviewed and revised the draft prepared by the working group and has approved the opinion.

Housing dogs outdoors permanently is relatively common in Norway, in particular polar breeds and sled dogs. Pure polar breeds, such as the Greenland dog, may cope with an ambient temperature as low as -25°C. The temperature tolerance observed in polar dogs does not apply to mixed breeds like Alaskan husky, due to variability in the thickness and structure of insulating fur. Animal welfare may be further compromised in these dogs by inappropriate housing and/or inadequate management routines. For example, housing dogs by tethering or keeping them in pens, overcrowding in large groups or social isolation, or not providing sufficient stimulation raises both health-related and welfare-related concerns.

Sled dog racing has become increasingly popular in Norway. Many dogs that participate in long-distance races, such as the Finnmark Race and the Femund Race, often experience health problems. Diarrhoea, vomiting, lameness, weight loss and frostbite are commonly reported, sometimes resulting in dogs being not permitted to continue the race. In Norwegian sled dog races, there are rules for obligatory resting at checkpoints, ranging from 8 to 33 hours in total, depending on the length of the race. Gastric ulcers are often associated with strenuous physical activity. However, the prevalence of gastric ulcers in dogs participating in sled dog races in Norway is not documented. These dogs are often given prophylactic treatment to prevent gastric ulcers.

The NFSA has requested VKM to describe indicators that could be used to identify dogs that are at risk of reduced welfare, both dogs that are housed outdoors and during the sled dog race season. VKM was also asked to describe specific risk-reducing measures related to environmental temperatures, crowding in large groups, housing in pens or being tethered, compulsory veterinary controls before or during races, sufficient resting in participating dogs and non-medical measures for avoiding gastric ulcers, diarrhoea and/or vomiting.

Weather conditions were identified as a hazard to animal welfare, both in relation to outdoor housing and sled dog racing. Factors such as type of breed, coat quality, age, body condition, injuries and diseases, exercise or rest during cold or warm days and other climactic factors all affect how well dogs cope under conditions of extreme weather. For dogs to be suited to cold weather conditions, exposed body parts should be covered by fur and the coat be extremely thick in order to avoid frostbite and hypothermia. However, the literature on thermoregulation and the effect of extreme ambient temperatures on canine breeds is limited, preventing a complete risk assessment. Low ambient temperatures do not generally represent a problem while dogs are running. Hyperthermia may become an issue in sled dogs with thick coats, especially during extensive physical work at warm winter days. Risk-reduction measures include access to a heated house or shelter with insulation, coats or blankets, clean, dry bedding and sufficient amounts of high quality feed and drinking water, and adjusting the strategy of running and resting during racing.

With regards to outdoor housing, additional hazards were identified in association with large group housing. Keeping dogs in such conditions, irrespective of whether tethered or kept in pens, increases the risk of exposing them to pathogenic agents. Puppies, as well as old/young dogs, are particularly vulnerable. Crowding dogs together may also expose them to social stress from more dominant individuals. However, assigning a specific risk is not possible as many factors are involved. Risk-reduction measures include daily removal of faeces, regular cleaning and disinfection of premises and equipment, and careful management of groups of dogs with stable hierarchies.

Both tethering and housing of dogs in pens restrict the space and amount of stimulation. Scientific documentation comparing the effects of tethering versus pen-housing is lacking. The risk of reduced welfare varies, depending on availability of space (whether penned or tethered), management/experience, and individual dogs.

Sled dogs are subjected to strenuous physical activities, both during racing and during the training season. There are currently no fail-safe indicators that can be used to identify dogs at risk of being subjected to unnecessary stress and strains pre-race. Standard clinical examinations, along with monitoring body condition scoring (BCS), and checking for sporadic vomiting, diarrhoea, lameness, and recurring cough reduces the risk. Compulsory veterinary controls by appropriately experienced veterinarians should alleviate some of the risks. Setting a higher minimum pre-race BCS for dogs may be a risk-reducing measure.

Clinical symptoms of severe disease may not be obvious, before, during, or immediately after completion of the race. Dogs with anorexia or severe diarrhoea are prone to dehydration or gastrointestinal dysfunction, and thus are at increased risk of reduced welfare if continuing the race. Dehydration can be determined by clinical examination of parameters such as appearance, eyes, mucous membranes, and skin turgor. Increases in respiratory rate, excessive respiration, rapid heart rate, and bright-red gingiva may indicate imminent hyperthermia. Dogs demonstrating repeated vomiting during a race have an increased risk of

aspiration pneumonia, may not obtain the required energy intake, and may develop more severe gastrointestinal-disorders and dehydration.

The current obligatory resting times set by the different race guidelines are not sufficient for recovery. Insufficient recovery period could result in fatigue or even fatalities, and is therefore a significant hazard. In fact, the total amount of time spent resting among winners has been reported to be nearly twice the amount of minimum time requirement stipulated. Previous experiences have shown that mushers who let their dogs run faster and allow them to rest more often tend to win the race more frequently, as compared with those that run more slowly but for longer periods. Increasing the obligatory resting time, starting with 10 h per day, e.g. 24 h period (which is the minimum biological requirement in dogs,) and adjusting upwards, will decrease the risk of reduced welfare.

The probability that prophylactic medical treatment with antacids will mask clinical symptoms of gastric ulceration is low, since such treatment reduces the occurrence of this condition. As gastric ulcers are often exercise-induced, it is important that mushers do not push the dogs beyond their limits. Longer and/or more frequent resting periods, along with provision of feed and sufficient drinking water, can reduce the risk of reduced welfare due to gastric ulceration.

Key words: VKM, risk assessment, Norwegian Scientific Committee for Food Safety, Norwegian Food Safety Authority, dog, welfare, sled dog race, breed, housing method, environmental conditions, management, health indicator, resting, prophylactic medical treatment, risk reduction

Sammendrag på norsk

Mattilsynet ba Vitenskapskomiteen for mattrygghet (VKM) om å vurdere risikoen for redusert dyrevelferd i forbindelse med permanent hold av hunder utendørs og for hunder som benyttes til langdistanse sledehundløp i Norge. Mattilsynet vil bruke risikovurderingen som et vitenskapelig grunnlag for å oppdatere «Veileder for hold av hund utendørs» fra 2003, og for at veilederen skal samsvare med Dyrevelferdsloven. Hensikten er å få et godt vitenskapelig grunnlag for å kunne bedre dyrevelferden, bedre retningslinjer for sledehundløp, og bedre rettledning for hundekjørere og løpsveterinærer.

En prosjektgruppe ble etablert med medlemmer fra Faggruppe dyrehelse og dyrevelferd og eksterne eksperter fra Norges miljø- og biovitenskapelige universitet. Faggruppen for dyrehelse og dyrevelferd har gjennomgått og revidert utkastet som ble utarbeidet av arbeidsgruppen, og har godkjent rapporten.

Hold av hunder utendørs er relativt vanlig i Norge, da spesielt hold av polarhunder og trekkhunder. Renraset polarhunder, som Grønlandshund, takler fint temperaturer ned til –25 ºC. Temperaturtoleransen hos blandingsraser, som for eksempel Alaska husky, er antagelig ikke like stor, på grunn av variasjon på tykkelse og struktur på pelsen. Dyrevelferden kan også bli utfordret ved måten hundene holdes på og ved mangelfull håndtering/aktivisering og stell. For eksempel vil permanent binding av hunder, hold av hunder i små innhegninger, høy dyretetthet i store grupper eller sosial isolasjon, eller lite stimuli utsette både dyrehelse og dyrevelferd for risiko.

Sledehundløp har økt i popularitet i Norge. Hunder som deltar i langdistanseløp, som Finnmarksløpet og Femundløpet, får ofte helseproblemer. Diaré, oppkast, halting, vekttap og frostskader er vanlig, og medfører noen ganger at hundene må tas ut av konkurransen. Ifølge retningslinjer fra arrangørene av sledehundløpene er det bestemmelser for obligatorisk hvile på sjekkpunktene. Hviletiden varierer fra 8 – 33 timer, avhengig av lengden på løpet. Magesår er ofte assosiert med anstrengende fysisk aktivitet, men frekvensen av magesår hos hunder som deltar i sledehundløp i Norge er ikke dokumentert. Hundene får ofte forebyggende behandling for å unngå magesår.

Mattilsynet ba VKM om å beskrive indikatorer som kan brukes for å identifisere hunder som står i fare for redusert dyrevelferd, både under utendørs oppstalling og under selve sledehundløpene. VKM ble også bedt om å beskrive risikoreduserende tiltak relatert til temperatur og værforhold, høy dyretetthet i store grupper, hold av hunder enten bundet eller i små hundegårder, obligatorisk veterinærkontroll før og under løpene, tilstrekkelig hvile for hundene under løpene og ikke-medisinske tiltak for å unngå magesår, diaré og/eller oppkast.

Værforhold ble identifisert som en risiko for dyrevelferden, både ved hold av hunder utendørs og under sledehundløp. Faktorer som rase, pelskvalitet, alder, hold, skader og sykdommer, trening eller hvile på kalde og varme dager og andre klimafaktorer er alle viktige for hvordan hunden klarer å tilpasse seg. For at hunder skal takle kaldt vær, må alle kroppsdeler være dekket med pels og pelsen må være tykk for å unngå frostskader og nedkjøling. Men, den vitenskapelige dokumentasjonen av temperaturregulering og effekt av ekstreme temperaturer for hunder er begrenset, og det er dermed ikke mulig å gjøre en fullstendig risikovurdering. Lave temperaturer er generelt ikke noe stort problem når hundene løper. Hypertermi eller overoppheting kan bli problematisk hos sledehunder med tykk pels, særlig ved høy arbeidsbelastning, ved varme vinterdager. Tiltak som kan redusere risiko for dyrehelse og dyrevelferd er tilgang til oppvarmet rom eller isolert hundehus, dekken, ren og tørr liggeplass, tilstrekkelige mengder fôr av høy kvalitet samt drikkevann og tilpasning av forholdet mellom aktivitet og hvile under løpene.

Når det gjelder utendørs hold av hunder, ble hold i store grupper identifisert som en risiko. Hold i store grupper øker risikoen for at hundene eksponeres for patogener. Det gjelder uansett om hundene er bundet eller holdes i hundegårder. Valper, så vel som eldre hunder, er spesielt utsatte. Høy dyretetthet vil også utsette hundene for sosialt stress fra dominante hunder. Det er imidlertid ikke mulig å fastslå en spesifikk risiko, ettersom det er mange faktorer som er involvert. Risikoreduserende tiltak er daglig fjerning av avføring, jevnlig renhold og desinfeksjon av området, og godt ettersyn og stell av hunder i grupper med stabile sosiale hierarkier.

Både permanent binding og hold i små innhegninger gir begrenset plass og få stimuli for hundene. I henhold til hva vi har funnet, finnes det ingen vitenskapelig dokumentasjon som sammenligner binding og hold i små innhegninger. Risikoen for redusert dyrevelferd varierer med tilgjengelig areal per hund, stell og hundeeierens erfaring samt også mellom individer.

Sledehunder blir utsatt for anstrengende fysisk aktivitet, både under løpene og under trening. Det er per i dag ingen sikre indikatorer som kan brukes for å identifisere hvilke hunder som står i fare for å bli utsatt for unødvendig stress og belastninger. Standard kliniske undersøkelser, sammen med vurdering av hold og undersøkelser for sporadisk oppkast, diaré, halting og gjentagende hoste, reduserer risiko for stress og belastninger. Obligatorisk veterinærundersøkelse av kvalifiserte veterinærer vil antagelig redusere risikoen for dyrehelse og dyrevelferd. Å heve grensen for minimums poeng utifra holdvurderingskart før løpet, bør vurderes som er et risikoreduserende tiltak.

Kliniske symptomer for alvorlig sykdom er ikke nødvendigvis åpenbare verken før, under eller rett etter løpet. Hunder med anoreksi eller alvorlig diaré er utsatt for dehydrering og mage- og tarmproblemer. Disse hundene vil ha økt risiko for redusert dyrevelferd hvis de forsetter løpet. Dehydrering kan påvises ved klinisk undersøkelse av utseende, øyne, slimhinner og elastisitet i hud. Økning av pustefrekvens, overflødig pust (hyperventilering), hurtig hjerterytme, og rødt/irritert tannkjøtt kan tyde på begynnende overoppheting. Hunder som kaster opp gjentagende ganger under løpet, har økt risiko for lungebetennelse, de får

muligens ikke et tilstrekkelig energiinntak, og de kan utvikle alvorlige mage- og tarmproblemer og dehydrering.

Gjeldende regler for hviletider i sledehundløp er ikke tilstrekkelige for at hundene rekker å ta seg igjen. Mangel på hvile kan resultere i utmattelse og til og med dødsfall, og er derfor en signifikant fare for dyrevelferd. Faktisk så er den totale hviletiden for de hundespannene som vinner løpene, rapportert å være nær dobbelt så høy som minimumskravene. Erfaring har vist at hundekjørere som lar hundene løpe fortere og lar hundene hvile oftere, tenderer til oftere å vinne løpene, sammenlignet med de som lar hundene løpe saktere men i lenger perioder. En økning av obligatorisk hviletid fra ti timer per døgn (som er det biologiske minimumskravet hos hunder) og oppover vil redusere risikoen for dårlig dyrevelferd.

Det er liten sannsynlighet for at forebyggende behandling med antacider vil skjule symptomer på magesår, da slik behandling nettopp skal redusere forekomsten av magesår. Siden magesår er forårsaket av trening og anstrengelse, er det viktig at hundekjørerne ikke presser hundene for mye. Lenger og/eller hyppigere hvileperioder, sammen med tilgang på tilstrekkelig mat og drikke, kan redusere risikoen for dårlig dyrevelferd som følge av magesår.

Abbreviations and/or glossary

Abbreviations

AAHA = American Animal Hospital Association

AST = Aspartate Aminotransferase

BCS = Body Condition Score

CK = Creatine kinase

ECG = Electrocardiogram

GI = Gastrointestinal

LCT = Lower Critical Temperature

NKK = Norwegian Kennel Club, *In Norwegian:* Norsk Kennel Klubb

NFSA = Norwegian Food Safety Authority, *In Norwegian*: Mattilsynet

NSAIDs = Nonsteroidal anti-inflammatory drugs

NSDRA = Norwegian Sled Dog Racing Association, *In Norwegian*: Norges Hundekjøreforbund (NHF)

REM = Rapid Eye Movement

SWS = Slow Wave Sleep

VKM = Norwegian Scientific Committee for Food Safety, *In Norwegian*: Vitenskapskomiteen for Mattrygghet

WBC = White blood cell

WSAVA = World Small Animal Veterinary Association

Glossary

Bergebyløpet = *In English*; the Bergeby Race

Brachycephalic = skull shape with short nose

Femundløpet = *In English*; the Femund Race

Finnmarksløpet = *In English*; the Finnmark Race

Homeotherm = (an animal) that maintains its body temperature at a constant level (usually above that of the environment)

Hyperthermia = elevated body temperature that occurs when a body produces or absorbs more heat than it dissipates

Hypothermia = reduced body temperature that happens when a body dissipates more heat than it absorbs/produces

Oligocephalic = Shape of skull in which nasal cavity is approximately equal in length to the cranium

Background as provided by the Norwegian Food Safety Authority

The request concerns both a risk assessment of animal welfare when dogs are housed permanently outdoors and when dogs are used in long-distance sled dog races.

Outdoor housing of dogs

Outdoor housing means that the dog lives outdoors with access to a dog house or something similar. Such housing of dogs permanently (year-round) or part of the year is relatively common in Norway, especially for sled dogs, but also for some farm dogs and hunting dogs. Polar breeds, such as Alaskan Malamute, Greenland Dog and Siberian Husky, are adapted to a cold climate and are often housed permanently outdoors. The Alaskan Husky is commonly used as a sled dog. This is not a recognized dog breed, but is a type of dog bred solely for sled dog abilities, and with some variation in appearance and constitution. Single-coated breeds, such as bird dogs and hounds ,have been crossbred with polar breeds to increase speed, resulting in dogs with a varying coat, seldom equivalent to that of the pure polar breeds. These dogs too are often housed permanently outdoors.

Dogs are housed loose in pens or tethered. Tethering is usually by attaching a chain to the revolving top of a pole, enabling the dog to move around the pole without shortening the chain. Tethering as a housing method has been repeatedly discussed, partly due to the fact that the previous animal welfare act banned tethering of dogs on leashes shorter than 10 metres. In 2003, the Norwegian Animal Health Authority, now the Norwegian Food Safety Authority (NFSA), issued "Guidelines for outdoor housing of dogs". These guidelines recommend a chain length of two meters for dogs tethered outdoors, provided that the dog can move in a complete circle around the pole. This corresponds to an area of around 12 m^2, which is the recommended size for a dog pen. Presumably this is representative of how these dogs are housed today. Dogs housed outdoors generate a number of notifications of concern from the public. These concerns are not only prompted by the housing method, but also conditions such as temperature, dog houses, and bedding.

The Animal Welfare Act from 2010 requires, amongst other things, that "*the animal keeper shall ensure that management methods, equipment and technical solutions which are applied to animals are suitable for the purpose of ensuring the animals' welfare* "(§ 8) and that "*the animal keeper shall ensure that animals are kept in an environment which is consistent with good welfare, and which meets the animals' needs which are specific for both the species and the individual. The environment shall give the animals opportunity to carry out stimulating activities, movement, rest and other natural behaviour. The animals' living environment shall stimulate good health and condition, and contribute to safety and wellbeing. Animals shall have access to suitable and safe shelter outside the normal grazing*

periods "(§ 23). The guidelines issued in 2003 need to be revised and accommodated to the existing animal welfare act. Pertaining to that, the NFSA requires an assessment of which criteria could be used, as well as a risk analysis on possible negative welfare consequences for dogs housed permanently outdoors. Requirements for freedom of movement, stimulating activities, housing and bedding, as well as suitability of dog types for tolerate low/high temperatures, are important topics of consideration.

Dog owners constitute a large and diverse group and many of them engage in commercial activities related to their keeping of dogs. Possible changes in housing requirements can result in administrative decisions requiring economic investments and practical adjustments for some dog owners. NFSA will therefore not amend the existing guidelines without thorough consideration.

Long-distance sled dog races

Several sled dog races are arranged in Norway annually. Amongst these, the Femund race and the Finnmark race are best known. Sled dog races are increasingly popular and have considerable attention from the media. The number of participants in long-distance sled dog races varies, but the more popular races usually comprise more than 1000 dogs. The dog handler/ participant must complete the race without help from ground personnel, both on track and at checkpoints. The organisers arrange sacks of feed depot prepared in advance by the dog handler / participant, and cold water is available at checkpoints. The organisers also have instigated a compulsory resting period to be carried out at specific locations. Alaskan husky is the most common type of dog used in long-distance sled dog races.

Many dogs experience health problems during long-distance races. Diarrhoea, vomiting, coughing, limpness and lameness result in many dogs not completing the whole distance. Inspections by the NFSA have revealed examples of dogs being treated with antibiotics and painkillers during the race.

The prevalence of gastric ulcers in dogs participating in long-distance sled dog races in Norway is not known, but according to the Norwegian Sled Dog Racing Association (NSDRA) this is a widespread problem. They claim that in most cases no clinical symptoms can be seen in dogs, either before, during, or directly after completion of the race. For this reason, NSDRA recommends treating all participating dogs with antacids before and during the race.

The distance of the Femund race is 600 km, with an expected finishing time of more than 3 days. In 2015, the 14-dog teams in the Finnmark race went a distance of 1100 km, with a compulsory resting period of 29 hours. The winner of this class had a race time of around 86 hours and a total resting / stationary period of 62 hours, with 11 dogs out of 14 finishing the race. The last person had a race time of 106 hours and a total resting / stationary period of 79 hours, with 8 dogs out of 14 finishing the race. Keeping the dogs in good condition is probably the single most important criterion for success. Therefore the best dog handlers are usually good at this. We believe, however, that there is a risk that less experienced dog

handlers may overstrain their dogs by allowing insufficient resting periods, and that the minimum resting periods required by the organisers are too short to reduce this risk.

In 2014, the NFSA had a working group observing the Femund race and the Finnmark race. They observed several situations and conditions that, according to the working group, should have been better regulated or enforced, including dogs' resting periods during the race, storing of dog feed, and the race veterinarians' assessment of lameness and health problems. Many dogs develop problems with diarrhoea / vomiting during long-distance races. It was observed that the organisers did not have sufficient criteria and procedures for removing dogs from the race. A report from the local NFSA describing observations and measures imposed on the organiser of the Finnmark race in 2014 is attached. These measures have largely been complied with. Feedback from NFSA inspectors of the 2015 race notes that conditions have improved.

The Animal Welfare Act regulates the use of dogs in competitions as follows:

"§ 26. Training, showing, entertaining and competition
Any person who trains animals and who uses animals which are used for showing, entertainment and competitions, including those who organise such activities, shall ensure that the animals:

- *are capable of carrying out the activity without being exhausted or injured,*
- *are not subjected to, or influenced by, substances or treatment which can render the activity unacceptable with regards to animal welfare,*
- *are not intentionally subjected to fear, injury or unnecessary stress and strains, and*
- *are not trained for or used in fights with other animals or people.*

The King may issue specific regulations regarding training, showing and competitions etc., including setting requirements regarding specific approval, or banning various forms of such activity, banning the use of certain species and banning certain forms of substances and treatment."

In addition to this legal text, sled dog races are covered by few official rules. The development of these races and increasing size of these arrangements mean that NFSA's surveillance and control has gained in importance, but also become more demanding. NFSA considers it necessary to develop tools for sled dog race inspections in order to safeguard dogs' welfare. New regulations for the use of animals in competitions and better guidance for dog owners, inspectors, and organisers are relevant actions. Pertaining to that, it is necessary to gather updated knowledge on the risk of possible negative animal welfare consequences when dogs are used in long-distance sled dog races, as a base for possible new requirements.

Terms of reference as provided by the Norwegian Food Safety Authority

Outdoor housing of dogs

1.1 Thermoregulation:

Sled dogs like Alaskan Huskies are often a cross between polar dogs and other, less densely coated dogs, such that their coats vary.

a. Which temperatures represent a risk of reduced welfare for polar dogs, such as the Greenland Dog and Alaskan Malamute?

b. What type and quality of coat should a dog possess as regards topcoat, undercoat, and amount of hair on the chest, belly, genitals etc. in order to be suited for outdoor housing as described in the introduction?

c. How do other factors, such as age, health, and body condition affect the risk of reduced welfare when dogs are housed outdoors?

d. What measures for risk reduction could be applied?

1.2 Keeping dogs in large groups:

Keeping large groups of dogs increases the risk of spreading infectious agents. The risk of dogs being subjected to social stress is also presumed to be greater in larger groups of dogs.

a. What is the risk of reduced welfare resulting from health problems when dogs are kept in large dog holdings? What are appropriate routines for prevention and treatment of illness in order to reduce the risk of transmission?

b. What is the risk of reduced welfare due to social stress when dogs are kept in large groups? What measures for risk reduction could be applied?

1.3 Housing method:

According to the Animal Welfare Act, animals shall be kept in an environment which is consistent with good welfare, and which meets the animals' needs, both species specific and individual. The environment shall give the animals opportunity to carry out stimulating activities, movement, rest and other natural behaviour. The animals' living environment shall stimulate good health and condition, and contribute to safety and wellbeing. Animals shall have access to suitable and safe shelter outside the normal grazing periods (§ 23).

Furthermore, management methods, equipment, and technical solutions which are applied to animals are suitable for the purpose of ensuring the animals' welfare (§ 8).

a. What is the risk of these requirements not being met, resulting in reduced animal welfare, when dogs are housed permanently outdoors, in pens or tethered?

b. What measures for risk reduction could be applied?

Long-distance sled dog races

2.1 Which indicators are suitable to identify dogs before the race that are at particular risk of being subjected to unnecessary stress and strains, such as strain injuries, illness, exhaustion, and death?

2.2 Would compulsory veterinary control before entering the race or more compulsory veterinary controls during the race be suitable measures for risk reduction?

2.3 Which indicators are suitable for assessing the total strain on a dog participating in a long-distance sled dog race? Examples include percentage of weight loss during the race, lameness, hydration status, pulse rate, voluntary intake of feed and water, voluntary start-up after resting, cold injuries, diarrhoea/ vomiting symptoms.

2.4 Organisers currently require a compulsory resting period that is insufficient for the vast majority of participating dogs, and it the dog handlers' responsibility to ensure that their dogs have sufficient rest. How long and how often should dogs in long-distance sled dog races rest in order to avoid a risk of reduced welfare due to insufficient recovery during the race?

2.5 The level of challenge in long-distance sled dog races is significantly affected by weather conditions. Most participating dogs do not have a coat corresponding to that of the polar breeds, and may be subjected to frostbite. In addition, traditional polar breeds may have problems if they are exercised at too high temperatures. Which temperature limits, also in relation to weather conditions, could be determined in order to reduce the risk of dogs being subjected to strains from heat or cold, thereby resulting in reduced welfare?

2.6 Organisers recommend that all participating dogs are given antacids before and during the race to avoid gastric ulcers.

a. What is the risk that such prophylactic medical treatment for gastric ulcers masks clinical symptoms resulting from the dog being subjected to excessive physical and/or mental strains?

b. What are the most important non-medical risk-reduction measures in order to avoid development of gastric ulcers when dogs are trained and used for long-distance sled dog races?

2.7 What are the most important non-medical risk-reduction measures in order to avoid occurrence of diarrhoea/vomiting when dogs are trained and used for long-distance sled dog races?

Assessment

1 Introduction

1.1 Literature search

Literature searches were conducted using PubMed, ISI Web of Knowledge, Google Scholar and/or by searching data archives at the Norwegian Veterinary Institute or the Norwegian University of Life Sciences (NMBU). No restrictions were set on date of publication or language of articles. Information was also obtained from the websites Iditarod.com and Femundlopet.no. Individual members of the working group also provided literature that was, if relevant, included in the report, based on their expertise on the topic

For outdoor housing of dogs, Boolean searches were used containing the following keywords (or combinations of), starting with "Dog" AND:

Breed, pen, shelter, thermoregulation, temperature, hypothermia, hyperthermia, heatstroke, heat stress, hair, fur, coat, weight, body condition score, social stress, large group, environment enrichment, stimulation, isolation, parasites, virus, bacteria, contagious diseases.

For long-distance sled dog racing, Boolean searches were used containing the following keywords (or combinations of), starting with "Sled dog" AND:

Breed, Iditarod, Yukon Quest, long distance racing, rest, sleep, sleep deprivation, sleep suppression, fatigue, gastric ulcer, prophylactic, endurance race, hydration, hypothermia, hyperthermia, frostbite, heatstroke, gastrointestinal disease, diarrhoea, exercise, injuries, canine endurance athletes, pneumonia, myopathy, circulation, heart disease, weight loss, body condition score.

1.1.1 Other sources of information

With regards to animal health and welfare related to long-distance sled dog racing, VKM also invited dog owners active in sled dog racing, as well as race veterinarians, in April 2016 to present their views as hearing experts. Each hearing expert was also asked to answer a set of questions, prepared by the working group. This information is summarized in Appendix II.

1.2 Outdoor housing and tethering of dogs in Norway

Guidelines in Norway

To our knowledge, there is no database providing an overview of how dogs are kept in Norway. In an MSc thesis, with the main aim of mapping the possible link between hair whorls and some personality traits in dogs, Sofie Lillebø generated an online survey, which was distributed via social media. Of the 915 dogs for which data were provided, 1.2 % were reported to be housed only outdoors, 10.1 % of dogs both indoors and outdoors, and the other 88.7 % only indoors (Lillebø, 2013). The representativeness of this sample with respect to the whole dog population in Norway cannot be assumed. Nevertheless, we can assume that the 1.2 % reported to be housed outdoors are mostly sled dogs. However, the number of sled dogs in Norway is not known. The only data we have that can indicate trends in terms of keeping dogs outside, is the database of the Norsk Kennel Klubb (NKK), which presents the number of dogs of specific breeds registered as being born in Norway each year. The database does not include mixed breed dogs, and the predominant type of sled dogs participating in long-distance races (and probably kept outdoors throughout the year) are categorized as Alaskan husky type dogs, which is not a separate breed, but a mix of several lines. In 2015, the total number of dogs registered in NKK was 25,864, from which the number of Siberian Husky dogs was 370, Alaskan Malamute 182, and Greenland dog 63. These are breeds that are traditionally kept outdoors.

The Animal Welfare Act, § 23 states that animals should have access to an appropriate and safe compartment/room. There is no directive on keeping dogs, but there are guidelines for outdoor keeping of dogs. Also, the NFSA has developed guidelines for dog keeping in general, and these are used by NFSA staff during inspections (Mattilsynet, 2014). This document can be considered as describing the minimum acceptable standards, as interpreted from the Animal Welfare Act.

According to the Norwegian guidelines for keeping dogs outside (Mattilsynet, 2005), each dog should have a minimum space allowance of 12 m^2, and if several dogs are kept together, the space should be increased by 7 m^2/dog. Also, when tethered, the dog should be able to move within an area of 12 m^2. Hence, the length of the line should be at least 2 m. Dogs kept tethered should be released several times each week, and for at least 10 hours per week.

The guidelines from The Norwegian Sled Dog Racing Association (NSDRA, In Norwegian: Norges Hundekjørerforbund, NHF) in 2008 recommend that dogs should not be kept loose in large groups. Furthermore, keeping dogs in small groups is termed as irresponsible, if the dog owner is not present. According to the guidelines, it is highly recommended that dogs are tethered individually. However, the text also underlines that the dogs should not be permanently tethered and proposes activities e.g. going for a walk, training, playing with other dogs, taking the dog inside to the house. At the same time, no limit is set regarding

the duration for which dogs can be allowed to be tethered, i.e. what is meant by permanent tethering.

Guidelines in Sweden and Finland

Swedish regulations state that when kept outdoors, dogs should not be kept permanently tethered (Jordbruksverket, 2008). If tethered, they should only remain as such for a maximum of 2 hours per day. The space allowance for a dog with height of withers > 65 cm in the yard is a minimum 20 m^2. For two dogs, the total space allowance is minimum 28 m^2, and, for each additional dog, the space allowance should be increased by 14 m^2.

According to the regulations in Finland, dogs can only be tethered permanently outside if close to a house with people present (Finlex, 2010). Dogs younger than one year cannot be permanently tethered. The space allowance for one dog tethered permanently should be at least 40 m^2. For dogs kept in yards, the space allowances are regulated according to the size of the dogs and number of dogs. For example, the minimum space allowance for a dog that weighs 40 kg is 15 m^2, whereas the total space allowance for 6 dogs (also 40 kg) is 34 m^2.

1.2.1 Welfare challenges related to outdoor housing of dogs

Housing dogs outdoors has both advantages and disadvantages compared with housing indoors. Depending on how the specific conditions of how dogs are housed outdoors (e.g. tethered or in a kennel, single or in group, presence of shelter and microclimatic conditions) and managed (quantity and quality of human contact, experience of caretaker, provision of enrichment), the exact level of risks of different factors listed below vary considerably. Housing dogs outdoors can have direct (e.g. exposure to weather conditions) and indirect (e.g. altered human-animal contact) impacts regarding their welfare and health. As these effects cannot always be clearly categorized into being direct or indirect, they are reviewed here without this distinction. As dogs housed outdoors are often kept in kennels, pens or tethered, literature on effects of keeping dogs in restricted areas are also presented here, and results from studies in laboratory and shelter dogs are described as appropriate. Scientific publications about the effects of housing on pet dogs, family dogs, or working dogs are scarce.

Behavioural signs of poor welfare in dogs can be passivity (too much resting, low body posture, low response to stimulation e.g., slow approach), or overexcitement (e.g., excessive barking, whining to irrelevant stimulation). Should behavioural needs not be met, stereotypies can occur. Stereotypies are repeated or rhythmic behavioural sequences without an obvious goal of the action, for example running to the border of the fence, or trotting at the edge of lead if tethered to a pole, pacing (switching from one foot to the other and back without locomotion). Poor welfare can lead to obsessed behaviour, like tail chasing (e.g. Beerda et al., 1999; Cafazzo et al., 2014; Hennessy et al., 2001; Hiby et al., 2006).

Thermoregulation in dogs housed outdoors

Animals can suffer when subjected to ambient temperatures that are too low or too high. In general, dogs kept outside are constantly exposed to the climate in the forms of wind, moisture, solar radiation, and high or low ambient temperatures. Different kinds of shelters can provide protection from wind, precipitation (i.e., rain. snow), direct sun, and thus buffer extreme climatic conditions. Managing dogs housed outdoors can therefore be challenging, as relevant weather conditions need to be considered.

The core body temperature of homoeothermic animals is regulated within narrow ranges; for dogs the normal temperature is given to be 37.5-39.0 °C during rest (Sjaastad et al., 2003). For day-active homoeothermic animals, body temperature is lower at night and increases during the day. Body temperature increases during physical activity and mental stress (Heinrich, 1977).

Adaptations to frequent or prolonged low temperatures may include development of a thicker hair coat with undercoat, and higher feed intake. Mushers often report that their dogs prefer insulated dog houses over non-insulated ones (Hearing expert Petter Jahnsen), without apparent loss of coat, whereas others are convinced about the negative effect of insulation of houses on coat thickness (Hearing expert Annette Kriller). Some mushers use protective sewed fur/fabric coats on exposed body parts of animals, e.g., on scrotum (Hearing expert Petter Jahnsen). All the experts also mentioned the importance of the quality of litter (deep dry straw), when dogs are resting or even using clothing (coat or blanket) on the dogs.

High ambient temperatures can also be dangerous for dogs; 70% of the total body heat loss is via radiation and convection (Hemmelgarn and Gannon, 2013). When ambient temperatures rise above 32 °C, evaporation is the most important mechanism for dissipating body heat in dogs (Johnson et al., 2006). Cooling of the brain is the crucial challenge in dogs at high temperatures, and the carotid blood is cooled in the upper respiratory tract, with the nasal mucosa acting as the main contributor to cooling. The critical ambient temperature for overheating is lower for brachycephalic dogs, i.e., animals with relatively shorter nose and presumably smaller nasal mucosa surface, compared with oligocephalic dogs (Bosak, 2004; Bruchim et al., 2006; Hemmelgarn and Gannon, 2013; Johnson et al., 2006).

Factors such as age, fur type, body size, coat colour, obesity and medical history can have a considerable influence on an individual dog's ability to cope with heat stress and its susceptibility to heat stroke. In a study with medium-sized mongrel dogs, Baker and colleagues (1974) observed that dogs had normal cerebral and body temperatures in warm environments (up to 45 °C), when breathing normally (i.e., through nose and open mouth). However, cerebral and body temperatures rose rapidly in these dogs, when normal breathing was replaced by tracheostomy, reaching 34 °C ambient temperatures (Baker et al., 1974). Dogs have a limited number of sweat glands and the majority of the evaporation process occurs in the nose, where the nasal mucosa, rich in arteries, provides a platform for cooling the blood running to the brain.

Dogs adapt behaviourally to high temperatures by preferring places with relatively low temperatures (shade over sunny places, soil or stone over carpet), reducing activity, lying on the side rather than in sternal recumbency, decreasing feed intake, increasing water consumption, and panting (Grandjean et al., 1998). Panting leading to cooling of the blood supplying the brain is more efficient when the mouth and nose are wet (dogs can produce saliva, unless they are dehydrated) and when the ambient air is dry (better evaporation). Brachycephalic dogs can have more difficulties with efficiency of panting, i.e. are at higher risk of heat stroke compared with dogs with "normal" (i.e. wild-type) head and nose shape (Bosak, 2004; Bruchim et al., 2006; Hemmelgarn and Gannon, 2013; Johnson et al., 2006). In general, dogs left in cars on hot summer days or working dogs with high physical activity are more exposed to the risk of overheating (Bruchim et al., 2006; Grandjean et al., 1998; Hemmelgarn and Gannon, 2013; Johnson et al., 2006). Heatstroke is the most severe form of hyperthermia, and can be defined as core body temperature being above 40 °C in humans and above 41 °C in dogs, combined with central nervous system symptoms and varying degrees of organ dysfunction (Bruchim et al., 2006; Johnson et al., 2006). High humidity or low wind speed hampers heat dissipation. Solar radiation may significantly increase heat load, especially in dark coloured dogs. Heat stroke has been described, even at ambient temperatures of 30 °C (Bosak, 2004), indicating that a clear cut-off environmental temperature cannot be defined for heat stroke.

Social needs

Dogs are a species that naturally live in social groups, participating in frequent social interactions with group members, both other dogs and people. Given the possibility, dogs may choose to rest in close proximity to other dogs or close to their owners (Adams and Johnson, 1993). In contrast to wolves, dogs have preserved their motivation for social play (with conspecifics or humans) into adulthood, which can be a consequence of their unique domestication history (Bradshaw et al., 2014; Gácsi et al., 2013). As part of their social life, when the opportunity for contact with other dogs arises then they participate at social play with other conspecifics, and show clear preferences for specific play partners over others within the same group (Bauer and Smuts, 2007; Ward et al., 2008).

Dogs are social animals and easily become attached to people. If dogs are kept outdoors, they may experience less contact with humans than dogs living inside human homes. Although a couple of minutes of daily contact with humans are enough to build attachment in dogs, sufficient social stimulation is crucial to prevent negative welfare consequences due to social isolation. Positive interactions (e.g., play, more gazing at humans) were found to lead to increases in the hormones β-endorphin, oxytocin, prolactin and the neurotransmitter dopamine in both humans and dogs, and even cortisol levels were decreased in humans after playing with their dogs (Nagasawa et al., 2009; Odendaal and Meintjes, 2003). Oxytocin plays a major role in developing and maintaining strong social bonds in mammals. The positive social interactions between humans and their dogs can lead to closer attachment between dogs and owners (a process in which this hormone can act as the main driver of positive feedback). Thus, these positive social interactions not only have short-term

positive effects on welfare, but also improve the relationship between dog and owner in the long-term.

Human contact has been proposed to be more important for dogs than contact with conspecifics (Wells, 2004; Meunier et al., 2012)). However, Poole (1998) suggested that contact with other dogs (e.g., keeping dogs in pairs or groups or providing opportunity for social activities) or even visual, olfactory and auditory access to conspecifics without physical access, may ensure fulfilment of social needs (Poole 1998). Social isolation was found to be as harmful or more harmful than spatial restriction in laboratory kennelled dogs (Hetts et al., 1992). Dogs housed in kennels prefer to position themselves such that they have visual access to other dogs (Wells and Hepper, 1998).

Dog-human interactions

Dogs kept inside normally live together with human families, which can contribute to more social contact with humans, more attention, and more training. We know that shelter dogs, with presumably limited contact with humans and less exposure to human communication signals, perform worse than pet dogs in dog-human communication situations, for instance following human pointing gestures (for a review see Duranton and Gaunet, 2016). Dogs that are kept outside have been observed trying to solve problems on their own, without trying to get help from their owners. In contrast, dogs living inside in the house together with their owner, actively gaze at their human partner in ambiguous or challenging situations; this can be interpreted as contact-seeking behaviour and a sign of asking for help, guidance, or social support (Topál et al., 1997).

Both the Norwegian guidelines (Mattilsynet, 2005) and the legislation in Sweden requires that handlers visit dogs kept outside at least twice daily, and more often for young or sick animals. Dogs should have social contact with humans for a few hours a day and social contact must be provided through the company of conspecifics or humans (Jordbruksverket, 2008). The legislation in Finland does not specify how often dogs kept outside should be checked or how much contact is needed, but does state that all dogs should be walked daily (Finlex, 2010).

If outdoor dogs are neglected or not provided with sufficient and appropriate human attention, there is risk of late identification of health problems and behavioural needs.

Stimulation

Dogs kept outdoors can be stimulated more by natural olfactory, visual, and auditory stimuli. However, since exploration is restricted most of the time, under-stimulation may occur, which, in turn, can lead to boredom, passive behaviour, and consequently lower welfare. In kennelled laboratory or shelter dogs, physical enrichments like resting places (Döring et al., 2016), a kennel inside a pen (Hubrecht et al., 1992), access to an outdoor area (Döring et al., 2016, Spangenberg et al., 2006) and toys (Meunier and Beaver, 2014; Schipper et al

2008; DeLuca and Kranda, 1992; Hubrecht, 1993; 1995) were found to stimulate dogs and hence improve their welfare.

The legislation in Sweden states that dogs kept outdoors must be provided with some enrichment, and enrichment should be tailored to the dog (Jordbruksverket, 2008).

1.2.2 Management

Dogs show high variability in how they cope in a social group. Some dogs may develop more stereotypical behaviours, fear reactions, or agonistic behaviours than other dogs, and it has been concluded that how dogs cope in groups depends on individual coping strategies (hearing expert, Arnt Ola Skjerve) (Dalla Villa et al., 2012). Signs of social stress can be mostly seen in dogs being suppressed by others, moving themselves away from the other dogs (e.g., in the back corner of the pen), showing low body posture, ears close to the head, tail down, frequent licking of the mouth, which can be targeted in attacks and threats from pen mates. Due to lack of possibility of escape, human observers sometimes have to intervene in dogfights in order to help the losing animal escaping from the attacks and to prevent serious injuries. Therefore, dogs kept in social groups need the frequent presence of skilled humans to identify possible suffering caused by social stress. It is also recommended that dogs that are being considered as pen-mates should be investigated thoroughly to determine which dogs will get along well together (Dalla Villa et al., 2013). Follow-up of social relationships between pen mates to identify possible conflicts is crucial for managing well-functioning social groups of dogs. This can be achieved by regular visits, long-term observation of groups, video recording, or visual observation from the house (e.g. window with a view of the dogs). Some apply tethering of dogs kept in groups or pairs during feeding times to prevent possible competition (Dalla Villa et al., 2013).

The NFSA recommends keeping at most four adult dogs loose in a social group (Mattilsynet, 2005). The legislation in Sweden allows up to 10 dogs in a group and specifies that only dogs familiar with each other and getting along well can be housed in a group (Jordbruksverket, 2008). The legislation of Finland does not specify conditions of group housing of dogs (Finlex, 2010).

While indoor dogs are taken for walks regularly, so that they can urinate and defecate outdoors, dogs kept outside often defecate at the place they are kept at. Faeces must be removed regularly and carefully to prevent diseases and to ensure dry, comfortable, and hygienic ground surfaces for the animals.

Heavy rain can result in muddy ground conditions and precipitation, such as snow, can also be a challenge when providing permanent access to feed, water, and dry shelter for dogs. At low ambient temperatures, water and feed may freeze and must be replaced several times each day. This was also highlighted by one of the interviewed experts (Hearing expert, Ingrid Wiik Haugbjørg). Owners should also consider equipping those dogs with a less dense hair coats with additional protective coats. At warm ambient temperatures, feed leftovers

decay more rapidly and more water is needed. Such circumstances require more daily visits to the dogs every day to ensure that dogs are provided with sufficient drinking water and that feed leftovers are removed.

The physical safety of dogs is also crucial when considering safe ways of kennelling or tethering dogs.

Although we were unable to identify any scientific study that focuses on management routines of dogs, practical instructions are normally detailed in guidelines, recommendations, and legislation. The NSDRA specifies the physical environment for dogs and importance of safe management practices. The NFSA also specifies that dogs kept outdoors should be given water at least twice a day (Mattilsynet, 2005).

Comparison of tethering and pen-housing of dogs

We could not find any literature comparing the effects of tethering a dog with housing dogs in pens outdoors. Scientific observations of dogs mainly focus on dogs kept in pens (indoor or outdoor), individually or in groups, with families as pets, or in large outdoor areas. The guidelines from the NSDRA, which are based upon the Mush with P.R.I.D.E. Sled Dog Care Guidelines, recommend tethering dogs rather than keeping them in pens. They argue that the sight of wiremesh or fencing could be more frustrating to a dog than being on a leash with a free view. No evidence for this recommendation could be identified. In addition, many dog holdings have an outer fence for safety reasons.

According to practice (no scientific studies found) based on comments from hearing experts, tethering dogs can be preferable to keeping dogs in pens. Advantages include: easier management, elimination of social stress caused by aggression, lack of competition, improved human contact with individual dogs, simpler for introducing and adding new dogs (Hearing experts, Annette Kriller and Ingrid Wiik Haugbjørg). The disadvantages of tethering over pen-housing include: restricted locomotion patterns, higher chance of developing stereotypic behaviours, boredom, restricted social contacts, limited development of social skills.

One of the hearing experts interviewed by VKM reported keeping dogs in pairs, groups, or tethered individually, depending on the dogs' preferences. The housing method of choice also depends on the dogs' previous experiences; agonistic interactions between dogs are rare (Hearing expert, Arnt Ola Skjerve). Most of the experts interviewed preferred tethering over pen-housing, claiming that tethered dogs are easier to manage, social conflicts are avoided even when unattended, handlers have an immediate overview of all the dogs, it takes less time to access a dog if any problems need to be solved, and less time is spent with management duties. Dogs that are tethered are easier to check and interact with than those that are housed in pens (hearing experts, Thomas Wærner, Petter Jahnsen and Ingrid Wiik Haugbjørg). Most of the experts stated that both tethering and pen-housing conditions can work well, if managed properly, and that the method chosen is mainly based on the

preference of handler and the dog (hearing experts, Annette Kriller, Arnt Ola Skjerve and Ingrid Wiik Haugbjørg).

Access to shelter and adaptation to cold temperatures

According to the Norwegian guidelines for keeping dogs outside (Mattilsynet, 2005), dogs should only be kept outside if they are adapted to a cold climate. Polar breeds and other breeds of dogs with well-developed fur/coats are considered to be suitable for being kept permanently outdoors. Dogs that have not developed a full coat should have access to an insulated shelter. In general, all dogs kept outside should have access to shelter that can protect them from precipitation and wind. Each dog in the group should have a separate lying place in the shelter.

The guidelines from NSDRA (2008) recommend that each dog in the group should have their own, separate shelter. The size of the shelter should be sufficient for the dog to be able to turn around.

According to the Swedish regulations (Jordbruksverket, 2008), dogs kept permanently in yards should have access to some kind of shelter. If there is no access to an indoor area, there should be a small "cabin" in the yard. Only dogs that are suited for, and individuals that are well adapted to, being outside may be kept permanently outside.

The Finnish regulations (Finlex, 2010) state that only dogs that are well adapted to being kept outside may be kept outside all year. Details regarding the design of shelters are provided, but there is apparently no requirement to actually provide shelter.

1.3 Long-distance sled dog racing in Norway

1.3.1 Physical activity in sled dogs throughout the year

Sled dogs that are subject to extreme activities during competition, as well as during the training season, may experience diminished animal welfare. Lack of exercise outside the training season could also present welfare problems among these dogs. In a study conducted on Alaskan huskies during summer, Delude found that the dogs (n = 11-15) spent more than 80% of time in recumbent posture, mostly with their eyes closed (Delude, 1986). This can be a sign of boredom and result from lack of stimulation. These dogs were tethered individually and had access to their own dog house, but had limited physical contact with other dogs.

Natural sleep activity pattern

Dogs spend a lot of time resting compared with many other species (Campbell and Tobler, 1984). Healthy adult dogs were found to rest from 7.7 to 12.9 hours a day (e.g. (Copley et al., 1976; Ettinger and Feldman, 2010; Lucas et al., 1977; Takahashi et al., 1981; Tobler and Sigg, 1986; Wauquier et al., 1979). The amount of sleep necessary depends on the age of

the dog: puppies usually rest more, young adult and senior dogs rest less (Kis et al., 2014), whereas data about activity patterns in old dogs are debated (Zanghi et al., 2016; 2013; 2012; 2010)). Dogs may sleep more after increased activity (Kis et al., 2014). The environment also has a substantial effect on the amount of sleep, like the duration of the light and dark periods, the daily activity of human contacts, and the novelty of the environment (Adams and Johnson, 1993). Auditory stimuli, such as barking, can disturb sleeping patterns (Adams and Johnson, 1994a), whereas listening to classical music was shown to lead to more rest in dogs (Kogan et al., 2012). Possibly linked to the environmental factors mentioned above, housing conditions, like keeping dogs in pens, caged, or in runs (Tobler and Sigg, 1986) or dogs kept in restricted areas/unrestricted areas/housed indoors (Adams and Johnson, 1993), can cause differences in the daily resting pattern of dogs.

Normal family dogs rest more at night, with only about 30% of rest during periods of light (Gordon and Lavie, 1984). However, Scott and Causey (1973) reported the opposite pattern in feral dogs (Scott and Causey, 1973). Drug detection dogs working in shifts have been observed to have similar sleep amounts and structures, regardless of whether they were observed after a shift spent working or after a period without working (Adams and Johnson, 1994b).

Architecture of sleep

Resting of dogs includes several cycles of sleeping with frequent shifts between different awake phases (Kis et al., 2014). On average, about 23 sleep-wake episodes can be observed in an 8-hours night-time resting, with 21 minutes cycles containing 16 minutes sleep and 5 minutes awake (Adams and Johnson, 1993). The sleeping cycles of dogs include a significant amount of drowsing, in contrast with humans, and daytime naps are essential parts of resting in dogs. The sleep of dogs contains also slow wave sleep (SWS)- and rapid eye movement (REM) phases, which are comparable in structure to those of humans (Kis et al., 2014).

Both the amount of sleep and the ratio of the different phases during sleep show high individual variability in dogs (Adams and Johnson, 1993; Kis et al., 2014; Tobler and Sigg, 1986), similar to that seen with humans (Banks and Dinges, 2007).

Sleep suppression and deprivation

There are multiple hypotheses about the role of sleep in animals, like the synaptic homeostasis hypothesis (Tononi and Cirelli, 2006) or the information processing hypothesis (Dickelmann and Born, 2010; Horne and Minard, 1985). Sleep suppression (reduced amount of sleep) or sleep deprivation (loss of sleep) can lead to an increase in time spent sleeping in the recovery phase, when given the opportunity. However, more characteristic is the change in the architecture of sleep, for instance prolonged SWS-phase can be observed after sleep deprivation, both in humans and dogs (Borbély, 1982)) (Takahashi et al., 1981). Sleep deprivation was found to lead to reduced motor activity in the recovery period in dogs (Tobler and Sigg, 1986). Total deprivation of sleep in the long term may lead to death. In

periods of sleep suppression, it was found in rats, that some parts of the brain go to off-mode, i.e., some brain parts do not function, while the animal is awake and looks normal (Vyazovskiy et al., 2011). In these cases, the behaviour of the animal can be somewhat altered, and the animal gives suboptimal reactions to environmental stimuli. The phenomenon of short-term bouts of impaired functioning is also called microsleep; in humans this can be as short as 0.5 seconds, but can last even up to 10 seconds (for a review, see (Banks and Dinges, 2007)).

There are extensive studies on the effects of sleep suppression in humans. Long-term sleep suppression has been shown to lead to added effects, similar to total sleep deprivation, including impaired cognitive functioning, impaired immune function, alterations in endocrine function (e.g., elevation in cortisol levels, increased sympathetic activation, decreased glucose tolerance) and a higher risk for cardiovascular events (for review see (Banks and Dinges, 2007)). In humans, the duration of sleep needed for optimal functioning shows high individual variation, and differences will be more prominent after sleep suppression. Presumably, the effects of sleep deprivation may be highly dependent on individuals in dogs as well. Studies on the effects of insufficient rest in sled dogs during races were not found in our literature search.

Rules for mandatory resting during long-distance sled dog racing

An adult dog normally sleeps 10 hours or more a day (Ettinger and Feldman, 2010). During long-distance races the dogs may become sleep-suppressed, as do the mushers. The different rules for obligatory resting times at the most famous long-distance sled races are summarized in Table 1-1.

Name of race	Total distance	Total obligatory stop	Distribution of stops (hours)
NHF rules (2015)	300-600 km	min 8 hours	no guidelines
NHF rules (2015)	above 600 km	min 12 hours	no guidelines
Femundløpet (2017), Femund 400	400 km	12 hours	4 + 8
Femundløpet (2017), Femund 600	600 km	20 hours	4 + 8 (musher) + 8
Finnmarksløpet (2017), FL-1000	1000 km	29 hours	3 + 16 (musher) + 10 (musher)
Finnmarksløpet (2017), FL-500	500 km	22 hours	2 + 6 + 14 (musher)
Bergebyløpet 650	650 km	33 hours	3 + 5 + 3 + 22 (musher)
Bergebyløpet 350	350 km	18 hours	2 + 3 + 3 + 10 (musher)
Iditarod (2017) odd years	1605 km	40 hours	24 + 8 (musher) + 8
Iditarod (2017) even years	1570 km	32 hours	24 + 8
Yukon Quest (2017)	1600 km	52 hours	8 + 4 + 36 + 4 (musher)

Table 1-1. Obligatory resting stops at the most popular long-distance sled races. 'Musher' indicates that the location of the stop has some flexibility; the musher has some level of control over that.

1.3.2 Animal health challenges in sled dog racing

In addition to physiological stress, sled dogs are likely exposed to psychogenic stress in the form of exposure to unfamiliar environments, interactions with unfamiliar conspecifics, and the race itself (Hekman et al., 2014). A stressful environment and an anxious personality are associated with large bowel disease in dogs (Leib, 2000). Dogs undergoing significant physiological stress in the form of exposure to physical exertion of a sled race are at increased risk of developing gastric lesions (Davis et al., 2003).

In general, all dogs should have a veterinary pre-check before a race. In Norway this is only required in two long distance races, Femundsløpet and Finnmarksløp, and includes physical examination. Information about obligatory veterinary pre-checks at Bergebyløpet could not be identified. The pre-check has to be conducted within the last 12 days ahead of the race, by the musher's local veterinarian or by a race veterinarian before the start of the race (Hanne-Marthe Andreassen, pers. communication). To fulfil the mandatory requirements for participation in the Iditarod Trail Race, the dogs have to have a through physical examination, a complete blood count, a serum biochemical profile, and an electrocardiogram. Dogs not satisfying the health requirements are excluded.

However, it may be difficult to identify dogs suffering from subclinical disease or at risk of being subjected to strain injuries, illness, exhaustion, and death during a race, by a veterinary clinical evaluation alone. Clinical symptoms of severe disease may not be obvious, either before, during, or straight after completion of the race.

During the Yukon Quest International Sled Dog Race in 1993, 15 out of 32 dogs were excluded from the race (Hinchcliff, 1996). Following a 17-dog sled at the Iditarod Trail Sled Dog Race in 1991, eight dogs were eliminated during the race, five of them due to fatigue or failure to perform (Burr et al., 1997). Approximately 30 % of participating dogs are removed from the Iditarod race every year.

According to information on the official website of the Iditarod Trail Sled Dog Race (Iditarod.com), in 2016 for the sleds that reached the end of the race, 64.6% of dogs completed the race. Statistics do not include those sled dogs that did not finish the race. In a study performed in 1995 at the Iditarod race, in which 261 dogs were monitored by researchers, 151 dogs were retired during the race, representing 42.5% of the study population (Hinchcliff et al., 1998). At the 600 km race of Femundløpet in 2017, where sleds with 12 dogs each compete, 24 teams completed the race with 191 dogs reaching the finishing line. This corresponds to 66.3% of dogs completing the race in the finishing sleds (http://rs.femundlopet.no/race/results/status.jsp?rid=57), assuming that all sleds started with 12 dogs.

As far as we know, there is no official registration confirming the number or cause of withdrawal of dogs during sled dog racing in Norway.

In published studies, based mainly on the long-distance sled dog races Iditarod and Yukon Quest, the main reasons of retiring dogs from races are listed as lameness, excessive fatigue, diarrhoea, and sore feet. The exact prevalence of the different reasons for removing sled dogs from long-distance races are not normally specified or published, and the data presented below are based on 8 and 32 dogs (Burr et al., 1997 and Hinchcliff, 1996, respectively). Therefore, conclusions cannot be reached based on these limited data, but should be considered as describing possible trends. Where the prevalence of these problems are specified, excessive fatigue was recorded in 47% (Hinchcliff, 1996) and 63% (Burr et al,. 1997), lameness or pad injuries in 41% (Hinchcliff, 1996) and 25% (Burr et al., 1997), diarrhoea in 6% (Hinchcliff, 1996) and 13% (Burr et al., 1997), dehydration in 3% (Hinchcliff, 1996) and fever in 3% (Hinchcliff, 1996) of cases.

In 23 dogs that died during the Iditarod Trail sled dog races between 1994 and 2006, recognized causes of death included aspiration of gastric contents (n=4), aspiration pneumonia (n=4), acute blood loss secondary to gastric ulceration (n=3), and sled dog myopathy (n=2) (Dennis et al., 2008). Pulmonary oedema, brain oedema, and possible drowning, were the presumptive causes of death identified in three more dogs. The cause of death was not established for the remaining seven dogs. The study population represented 0.15 % of approximately 15 600 competing dogs. Lesions commonly observed in the dogs with race-related deaths included rhabdomyolysis (n=15), enteritis (n=10), gastritis (n=10), gastric ulceration (n=10), aspiration pneumonia (n=8), centrolobular hepatocellular necrosis (n=6) or centrolobular hepatic fibrosis (n=3), gastric dilatation (n=3), and cardiac myodegeneration and necrosis (n=3) (Dennis et al., 2008).

According to information from the Norwegian Veterinary Institute, ten sled dogs were autopsied during 2005-2016. Information regarding time of death (e.g., during or shortly after a race) was not available. Main lesions observed in these dogs were cardiac insufficiency (n=6), pneumonia (n=1), and dehydration/chronic nephritis (n=1). In two dogs there was no diagnosis due to autolysis.

A substantial proportion of well-trained sled dogs that die during competition lack lesions to account for death. However, in contrast with equine and human athletes, unexpected death of endurance-racing dogs may result from aspiration pneumonia, gastric mucosa lesions, and sled dog myopathy (Dennis et al., 2008).

1.3.2.1 Water balance

During long-distance racing, the normal regulation of fluid balance may be challenged.

The body mass of an adult and relatively lean animal consists of 60-70% water (Sjaastad et al., 2003). Approximately 65% of the body water is found inside the cells, the rest constitutes interstitial fluid, blood plasma and lymph. The osmolarity within the cells and the interstitium is normally equal.

Water is lost from the body through urine and faeces, water vapour in exhaled air and evaporation. If the dog suffers from diarrhoea, significant fluid may be lost. Dogs do not

have sweat glands in the skin, but lose water from the tongue (i.e., evaporation of saliva) when panting. Most dogs have sweat glands around their footpads, but this is not so in pure polar breeds. Water is obtained from feed, water, and as a result of body metabolism. Sensory cells for osmolarity in the hypothalamus brain region control secretion of the anti-diuretic hormone (also known as vasopressin). This hormone/neurotransmitter sends signals to the thirst centre (located in the hypothalamus). Thus, when the osmolarity of the extracellular fluid increases, reabsorption of water over the kidneys increases, and the animal feels thirsty and is motivated to seek water and to drink. However, when a dog is exhausted or stressed, it may be difficult for the musher to ensure that the dog drinks a sufficient volume.

Normally, the amount of water in the body varies only slightly from day to day. The abilities of the body to concentrate urine and increase the intake of drinking water are the two main ways a dog can regulate water balance, i.e., by reducing water loss or increasing water gain, respectively. Water balance is linked to temperature regulation. For example, evaporation of water (e.g., panting) is a mechanism for heat dissipation.

During a long-distance race, dogs use 10 to 20 times more water than usual, which is partly met by a high-fat diet and drinking. Biochemical evidence of dehydration in long-distance sled dogs was not found in a study on limited number of dogs (Hinchcliff et al., 1993). Both NSDRA and specific race guidelines note the possible risk of dehydration. Dogs with anorexia (caused mainly by stress during race) or diarrhoea are particularly prone to dehydration (Grandjean et al., 1998). In general, checking for dehydration is part of the routine veterinary check and, if greater than 7% of hydration is lost, then dogs are excluded from the race until they recover (Grandjean et al., 1998).

The degree of dehydration that can easily be diagnosed by clinical examination (i.e., based on skin turgor, mouth mucosa dryness).

1.3.2.2 Temperature regulation in dogs during races

Core body temperature is regulated within narrow limits in dogs (Sjaastad et al., 2003). Sled dogs are prone to either hyperthermia or hypothermia, depending on season of the year and circumstances.

Hyperthermia

Muscle activity yields 20% work and 80% heat. Thus, during a race overheating may become a problem if heat dissipation is hindered and the ambient temperature is high. This may occur even in winter, especially for dogs with a thick fur coat and/or a layer of subcutaneous fat (high body condition score) that insulate the body. Insufficient water intake will add to the problem, as the cooling effects of panting and evaporation (from the tongue) will be hampered. A core temperature of 43-44 °C is usually fatal.

In relation to long-distance sled races, overheating was considered to be a problem in Norway, according to the hearing experts. The training season for sled dogs in Norway normally starts in September. In Southern Europe, physical exercise and training of sled dogs is met by swimming during hot weather, and sled races are cancelled if the ambient temperature exceeds 10 °C.

Upon arrival at checkpoints during races, dogs are often reported to have a rectal temperature of 41.4 °C, which decreases to normal within 20 minutes. Life-threatening hyperthermia can occur already at ambient temperatures above -7 °C (Grandjean et al., 1998). Early signs of hyperthermia include increased respiratory rate, excessive salivation, rapid heart rate, and bright-red gingiva (Grandjean et al., 1998).

Hypothermia

Long-distance sled dog races are arranged in the winter season, when the ground is snow covered and solar radiation is limited. Concerns have been raised regarding the effects of low ambient temperatures, especially during rest hours. Whereas as the upper limits for body temperature that can be fatal are not very far from normal body temperature, there are larger margins for hypothermia. Lethal lower body temperature is around 25 °C. Dogs that are sick and dehydrated are at higher risk for sub-optimal thermoregulation, including hypothermia, during resting (Grandjean et al., 1998).

Local frostbite on exposed body parts that are not fully protected by fur, like the scrotum, vulva, nipples, prepuce, penis, flank folds, may occur if the tissue cools to 0 °C or below. Paws are less vulnerable to frostbites, and socks are used to avoid icing and sore feet (Grandjean et al., 1998).

1.3.2.3 Musculoskeletal disorders

Stiffness and lameness are common among dogs participating in long-distance races. Stiffness often becomes evident after rest, but usually disappears when the dog starts moving and warms up. The observation time must be sufficient for deciding whether or not the condition is transient. Lameness is a common cause of dogs being excluded from a race (Burr et al., 1997; Hinchcliff, 1998).

Sled dog myopathy may present as mild and of little clinical significance, and is likely to be associated with muscle fatigue and transient pain and stiffness. Myopathy may also be extensive, involving large areas of muscle. It is then considered as a life-threatening condition (Dennis et al., 2008).

The cause of sled dog myopathies is still unknown, but the pathogenesis may involve oxidative stress, electrolyte imbalance, lipid disorders, mitochondrial injury, or metabolic alterations. Deficiencies in nutritional components, such as vitamin E, have been suggested as possible predisposing factors. However, there is no documented association between pre-race plasma vitamin E concentration and the risk for development of exertion-associated

rhabdomyolysis. Administration of an antioxidant supplement failed to attenuate exercise-induced increases in plasma creatine kinase (CK) activity in sled dogs (Piercy et al., 2000; 2001)

From human studies, it is stated that the more an athlete runs during training, the lesser the risk of injury on race day (Caselli and Longobardi, 1997). It is reasonable to assume that this finding may be extrapolated to sled dogs.

1.3.2.4 Gastrointestinal disorders

Sustained strenuous exercise has been associated with morphological and physiological changes in the gastric mucosa of Alaskan racing sled dogs (Davis et al., 2003a, 2005;, 2006; Royer et al., 2005). The lesions are often asymptomatic and not correlated with a negative effect on performance. The prevalence and severity appear to be unrelated to distance or duration of exercise. Gastric lesions seem to occur within the first day of sustained exercise; and there is no evidence that lesions become more severe over the course of that challenge (Davis et al 2003a, b, 2006). This finding was supported by research from Ritchey et al., (2011), which demonstrated that gastric inflammation did not increase in either prevalence or intensity over time and distance among exercised animals. The lack of progression of the gastric lesions suggests either increased capacity for gastric mucosal restitution or reduction in acid secretion to minimize further trauma. By extension, if these adaptive processes occur, then failure in these processes could be a key event in dogs in which gastric lesions become clinically evident (Davis et al., 2006).

The prevalence of gastrointestinal inflammation in conditioned sled dogs is unknown, but histologically verified gastritis and enteritis were common among 23 dogs with race-related deaths (Davis at al., 2008). The histological changes were nonspecific and usually mild, and in no instance was a primary aetiological agent identified. It is therefore unclear whether these lesions are exercise related or more strongly influenced by the unique husbandry of sled dogs. Inflammation of the gastrointestinal mucosa does not seem to be prevalent among humans or equine athletes (Davis et al., 2008).

Few studies specifically address the mechanisms underlying the development of exercise-induced gastrointestinal disease in dogs. There are many proposed causes, but none has been proven definitively to date (Davis and Williamson, 2016). Hyperthermia-induced mucosal permeability is a leading candidate for initiation of gastric mucosal lesions (Davis and Williamson, (2016); Shapiro et al., (1986); Colart et al., (1988); Prosser et al., (2004). With chronic, repeated periods of hyperthermia, intermittent paracellular acid leakage not only causes chronic subclinical inflammation, but also sets the stage for acute exacerbation of the disease on the first day of competition (Davis and Williamson, 2016).

Other working dogs are also at risk for gastrointestinal problems when performing strenuous exercise. This has been demonstrated in a study of field trial retrievers (Davis et al., 2016). In retrievers used for off-leash explosive detection work, 84 % prevalence of severe gastric ulcers was observed after five consecutive days of exercise (Davis et al., 2014).

In sled dogs, diarrhoea may be a result of infection, feed of poor quality, inadequate feeding regime, dehydration, or may be exercise/stress-induced (Long, 1993). McKenzie and colleagues (2010) demonstrated that common enteropathogenic microorganisms, like *E. coli* O157, *Campylobacter* spp*., Salmonella* spp*., Clostridium perfringens, Clostridium difficile, Giardia* and *Cryptosporidium,* were not associated with diarrhoea and/or haematochezia (fresh blood in the faeces), in sled dogs participating in long-distance racing. It would be expected that a heavy parasite burden might have a detrimental impact on the potential achievement of the sled dogs, together with a probable impaired immune defence, due to stress, transportation, and racing. Infection with protozoa seems to have less adverse effect on sled dog health than tissue-feeding nematodes (Bajer et al., 2011), but infection intensity and other concomitant factors should be taken into account.

The cause of gastrointestinal dysfunction, including diarrhoea and haematochezia in racing sled dogs may represent the effect of prolonged exercise on the gastrointestinal tract, possibly analogous to that occurring in human runners. Direct measurements of visceral blood flow in trained sled dogs exercising at typical ultra-endurance racing speeds found no reduction in splanchnic blood flow (van Citters and Franklin, 1969). This suggests that, at least in these populations (as well as populations exercising at a similar intensity or lower, such as explosive detection dogs), splanchnic ischemia is not a major factor in the development of disease. (Davis et al., 2016) However, other studies have demonstrated that exercise, even at moderate intensity, can significantly reduce splanchnic blood flow, which may have consequences for mucosal integrity and intestinal contractility (Qamar and Read, 1987; Peters et al., 2001; Mckenzie et al, 2010).

Prophylactic medical treatment of gastric ulcers before and during race

Although the specific aetiology of exercise-induced gastritis is unknown (Moses, 1990), the current treatment recommendations in both humans (Moses, 1993) and veterinary medicine (Papich, 1993) involve reduction of acid secretion. This is based on the hypothesis that development of gastric ulcers requires acid, pepsin, and impaired mucosal defences. An elimination of any of these factors will ameliorate damage (Davis et al 2003). Studies have shown that exercise *per se* does not increase acid and pepsin secretion in humans (Gritti et al., 2000; van Nieuwenhoven et al., 1999) and dogs (Kondo et al., 1994). However, sustained strenuous exercise does increase circulating cortisol in humans and dogs, including racing sled dogs, and glucocorticoids may impair mucosal integrity of the gastrointestinal tract, potentially leading to development of gastritis and gastric ulceration (Ferguson and Hoenig, 1995). Despite the lack of detailed information on the pathogenesis of exercise-induced gastrointestinal dysfunction, successful management of the condition has been reported in both human (Moses, 1993; Butcher, 1993)) and equine (MacAllister et al., 1999; Murray et al., 1997) medicine by the use of drugs that suppress gastric acid secretion. Many studies have been performed to determine effectiveness of famotidine, an H_2-receptor blocker, and omeprazole, a proton pump inhibitor, in preventing gastric ulcers in racing sled dogs (Williamson et al., 2007; 2010; Davis et al., 2003) Omeprazole seems to be more effective in reducing the number and severity of gastric lesions in racing sled dogs, than famotidine. If administered 30 min prior to feeding, efficacy can approach 100% in

preventing clinical significant lesions, during even the most strenuous exercise events (Williamson et al., 2010).

The treatment of exercise-induced gastric disease is not dissimilar to the treatment of gastric ulcers of any other cause. However, the only exception is the possibility of stopping the inciting cause, the exercise, which is a prominent aspect of exercise-induced gastric disease. There is little probability that prophylactic medical treatment will mask clinical symptoms of gastric ulceration, because the treatment reduces the manifestation of this condition. In veterinary medicine, human formulations are used that are assumed to have a low incidence of adverse effects in dogs (Sullivan et al., 2016)

Omeprazole has been associated with a slightly increased occurrence of diarrhoea in humans and in a study of sled dogs (Adams et al., 1988; Davis et al., 2003)). Racing sled dogs have a higher frequency of intermittent diarrhoea, and it is possible that omeprazole may exacerbate an underlying disease process rather than create additional pathology. A gastrointestinal dysbiosis may occur following omeprazole therapy. Although the clinical significance of microflora shifts is currently unknown, there is evidence that orally administered omeprazole can alter the quantitative abundance of several bacterial communities throughout the GI tract of healthy dogs (Garcia-Mazcorro et al., 2012; Sullivan et al., 2016). This also includes the pharyngeal flora (Sullivan et al., 2016). Gastric suppressors have been associated with an increased risk of both community- and hospital-acquired pneumonia in people (Eom et al., 2011). It is possible that administration of gastric acid suppressors is associated with adverse effects in hospitalized dogs, including the development of pneumonia. Future studies evaluating the influence of gastric acid suppressors on the gastrointestinal flora are warranted.

Feed additives are commonly used for prophylactic treatment of gastric ulcers in horses, but use of feed additives for prophylactic treatment of canine gastric ulcerations has not been fully investigated. Gastric ulceration is highly prevalent in horses, and there is a large commercial market for feed-additives and non-licenced products that claim to be effective for prevention and treatment of gastric ulceration. ImproWin has been used as a feed additive in horses and may aid the healing process of ulcers of the gastric squamous mucosa of trotters. A similar canine product may be of clinical interest for treating spontaneously occurring gastric ulcers of the squamous mucosa in dogs.

1.3.2.5 Other diseases

Aspiration of gastric content and aspiration pneumonia was recognized as an unexpected cause of collapse and death in 8 of 23 dogs with race-associated deaths (Dennis et al., 2008). Gastric disease seemed to be an important predisposing factor, as all the dogs with aspiration pneumonia also had concurrent gastritis, gastric ulcers, or erosions. However, gastric mucosal lesions are also common among competing sled dogs that do not die during racing (Davis et al., 2003) and among exercising humans and horses (Murray et al., 1996; Begg and O'Sullivan, 2003; Choi et al., 2001; Moses, 1993). It has not been determined

whether the gastric lesion precedes the aspiration, or vice versa; that stress secondary to the acute aspiration pneumonia may result in gastric ulceration. The prevalence and severity of gastric lesions in sled dogs were found to be unrelated to distance run, speed of running, or days of competition (Ritchey et al., 2011; Davis et al., 2003a; 2003b; 2006).

Epidemiological surveys in human cold-weather athletes have found a high prevalence of airway inflammation and hyperreactivity (Leuppi et al., 1998; Sue-Chu et al., 1998; Provost-Craig et al., 1996). As in human medicine, veterinarians cannot exclude an effect of exercise-induced asthma on animal performance, especially when exercising in cold conditions (Davis et al., 2002). Findings from bronchoscopy and bronchoalveolar lavage in elite racing sled dogs after completion of a 1100 mile endurance race supports the hypothesis that strenuous exercise in cold environments can lead to lower airway disease (Davis et al., 2002).

Acute heart failure may be the cause of death in sled dogs and is difficult to foresee. Arrhythmia may be intermittent and thus not discovered during pre-race auscultation or through pre-race electrocardiography. Turk and Root (1983) observed that subjective biventricular hypertrophy was common among dogs that died during racing. This finding is in agreement with echocardiography studies of sled dogs completing endurance training demonstrating cardiac hypertrophy (Stepien et al., 1998; Hinchcliff et al., 1997; Constable et al., 1994; 2000). These changes are thought to represent physiological adaption of the heart in athletic individuals to sustained exercise, rather than manifestation of cardiovascular disease. Lesions in the cardiac conduction system have been identified in some dogs that died during races (Bharati et al., 1997; Dennis et al., 2008). Thorough examination of the cardiac conduction system is difficult, and it is possible that cardiac conduction system lesions are underreported in autopsies. Discovery of lesions that account for death may be difficult.

2 Hazard identification and characterisation

2.1 Hazards related to outdoor housing

2.1.1 Weather conditions

We know little about how different factors influence thermoregulation of dogs. Temperature tolerance will depend on animal-specific factors like fur coat, body condition score (BCS), feeding, metabolism, habituation, and the facilities like shelter and lying surface, and climatic factors, such as wind and precipitation. For traditional polar dog breeds, low winter temperatures will not normally represent a risk for reduced welfare, provided that the dogs are healthy and properly fed, and have access to a sheltered lying area. Studies on Inuit sled dogs in Greenland show that lower critical temperature (LCT) can be as low as – 25 °C, as they have the same level of basic metabolic rate in the summer and winter (Gerth et al., 2010). Data on LCT for different dog breeds are sparse, but studies on LCT cannot be generalized, due to the above-mentioned factors, and are therefore only indicative. Alaska husky, currently the predominant sled dog in Norway, have variable and usually poorer coat quality than traditional polar dogs, due to the fact that this is a population of cross-bred dogs. Norwegian summer temperatures may become a challenge for dogs housed outdoors, especially if dogs do not have access to shade and drinking water.

In order to be suited for outdoor housing, a dog's coat should have a thick woolly undercoat and a topcoat that prevents precipitation soaking into the undercoat. The ears should be relatively small, and covered with hair including on the inside. The belly, scrotum, and teats are usually well protected when dogs are at rest in a curled position on an insulated and dry surface (e.g., straw).

With regards to age, puppies have poorer thermoregulatory ability than adult dogs. Old dogs may have reduced metabolism, and therefore reduced heat production, and also musculoskeletal disorders that cause stiffness and pain in cold weather. Diseases and low BCS (low BCS reduces body insulation) are also risk factors for reduced welfare if housed outdoors in a cold climate.

Summary – Weather conditions

Certain dog breeds/types cope less well with extreme ambient temperatures than others. Ambient temperatures, together with other climatic factors, such as moisture, wind, direct sun, may therefore represent a welfare hazard for dogs housed outdoors.

2.1.2 Large group housing

Contagious diseases and parasites

Dogs that are kept on premises with many dogs, and especially if they have close contact with others are at greater risk of being infected with viruses and potentially pathogenic bacteria. Several studies have investigated the risk of parasitic infection in larger groups of dogs.

Bajer and colleagues (2011) studied risk factors and control of intestinal parasitic infection in sled dogs in Poland. Kennel size was the most significant factor influencing prevalence and abundance of parasites and species richness, with much higher values of infection parameters found in large kennels (> 3 dogs). In small kennels (1-3 dogs), only infection with *Toxocara canis* (roundworm) were observed, but in kennels with more dogs, three nematode types, *Toxocara* sp., *Ancylostoma/Uncinaria* (hookworm), and *Trichuris* sp. (whipworms), were commonly detected. The prevalence of *Cryptosporidium* spp. was very similar in both small and large kennels, but the prevalence of *Giardia duodenalis* was twice as high in large kennels. Altogether, the prevalence of protozoa was significantly higher in kennels with more than three dogs. Species richness of intestinal parasites was several times higher in dogs housed in large kennels. Similar findings have been published previously (Pullola et al., 2006; Bugg et al., 1999).

Asymptomatic and clinically healthy dogs may be infected with *Giardia*, *Cystisospora* or *Ancylostoma/Uncinaria*, and they represent important reservoirs as direct or indirect sources of infection for other hosts (Lappin, 2005.). The potential of sled dogs contaminating the environment with the infective stages of parasites (eggs, cysts, or oocysts) is expected to be extremely high, in kennels, during training /racing, and at race meeting sites (Bajer et al., 2011). *Salmonella* spp. may be a zoonotic problem, although the *Salmonella*-status among racing sled dogs in Norway is, as far as we know, not known.

Sled dogs for long distance racing are usually kept on premises with many more than 3 dogs, and risk factors for transmissible diseases are generally high.

Social stress in large crowded groups when kept in pens

Multiple dogs kept outdoors, unattended, or with minimal human care, can develop problematic behaviours, such as escalated barking. This can lead to both poorer welfare of animals (Sales et al., 1997) and conflicts with human neighbours. If free physical contact with other dogs is permitted (when housed in pairs or groups), this may be beneficial for positive social interactions, including play, which is an indicator of positive welfare. However, due to restricted space limiting the opportunities for retraction and escape, there may also be a higher chance of territorial or possessive conflicts; agonistic interactions between dogs can escalate into fights with a potential for injuries. Therefore, regular observations of dog-dog social interactions are necessary to ensure that dogs that share a pen are well matched. Measures should be instigatated to avoid accidental social interactions that may result in fights - or resulting in pairings that may lead to unwanted puppies. Even when dogs are

individually housed in pens or tethered, thereby preventing any physical encounters, dogs may be stressed by dominant/aggressive neighbour dogs.

Insufficient human contact

Dogs kept outside may have limited contact with humans, but this is highly dependent on the handler and their management practices. Limited contact may mean that behavioural needs and poor health of animals are identified late, or not at all. Most dogs are motivated towards contact with humans, based on their domestication history and individual life experiences.

Summary – Large group housing

When many dogs are kept on the same premises in a confined area they will be exposed to each other's contagious diseases, including intestinal parasites. These dogs may potentially experience higher levels of social stress. Such conditions may represent a risk of reduced human contact and delayed recognition of disease or other problems. Large group housing of dogs therefore represent a hazard to animal welfare.

2.1.3 Pen housing and tethering.

Animals often develop stereotypies if their space is restricted; these may include pacing at the fence, circling the border of the pen, running in circles around the pole to which the animal is tethered. These stereotypies may both indicate and lead to bad welfare (Hubrecht et al., 1992). Tethering and pen-housing of dogs can compromise the welfare of animals, as both methods restrict the space and amount of stimulation for dogs.

If given the access, dogs kept in pens choose to go out to outdoor areas and by this, increase their area of use (Döring et al., 2016). Recommendations for laboratory dogs kept in permanently confined places, such as in a pen, include being provided with stimulation in the form of training, socialization, human contact, and environmental enrichment with toys (Meunier and Beaver, 2014). Laboratory dogs provided with environmental enrichment were found to show more active behaviours, increased appetite, and lower frequency of excessive barking (Schipper et al., 2008). Unfortunately, scientific data on effects of housing on pet dogs, family dogs or working dogs are scarce. The few studies considering the effect of pen size on the welfare of individually housed dogs found that the space available has minor effects on the activity of dogs (in the framework of pens) compared with group-housing (at least two dogs together) with more space available (Neamand et al., 1975; Hite et al., 1977; Campbell et al., 1988).

Most mushers in Norway appear to prefer tethering. This is based on their experience, rather than on scientific evidence. Tethering is not a usual housing method in dogs (long-term tethering is banned in many countries, and shelter- and laboratory dogs are mainly kept in kennels or pens), and this may explain why studies investigating welfare issue in tethered dogs were not found.

A dry lying surface decreases heat loss to the ground and hence increases tolerance of low temperatures. An insulated doghouse will, if the entrance is protected by a cover, be warmed up by the body heat of the dog such that the inside temperature rises above the outdoor ambient temperature.

The degree to which dogs cope with their environment when tethered or housed in pens depends on management routines, the experience of the handler, and the individual dogs.

Summary – Pen-housing and tethering of dogs

The minimum requirements for both tethering and pen-housing of dogs can compromise the welfare of animals, as both methods restrict the space and amount of stimulation available. Therefore, these two housing methods may represent a hazard to animal welfare.

2.1.4 Other hazards related to outdoor housing of dogs

Lack of exercise

Lack of physical exercise and too little or too much stimulation are known to compromise animal welfare in many different species. Lack of exercise in animals that usually have an active life style, may result in frustration and stereotypic behaviours, such as pacing or circling, and a rebound activity may occur when such animals are allowed to move to a large arena (Hubrecht et al., 1992; Titulaer et al., 2013). Too little stimulation may result in apathy (abnormally long resting, low responsiveness, learned helplessness), whereas too much stimulation may cause agitation, excessive barking, and circling.

In contrast to dogs kept in homes, outdoor-housed dogs do not need to be taken for a walk to defecate and urinate, and it is possible to skip daily training/walks. Exercise outside the training season is therefore totally dependent on management procedures. In Sweden, dogs cannot be tethered for more than 2 h per day and the minimum kennel size is larger than in Norway (see section 1.2). A larger kennel provides dogs with more freedom to play and run at speed.

2.2 Hazards related to long-distance sled dog races

2.2.1 Weather conditions

Hyperthermia

When heat dissipation does not exceed heat production, dogs, like other animals, can suffer from heat stress (hyperthermia), which can develop into fatal heatstroke. For different levels of hyperthermia in dogs, see (Hemmelgarn and Gannon, 2013). Heatstroke is characterized by core body temperature >41 ^{o}C, symptoms from the central nervous system and organ dysfunction.

Heatstroke can be divided into two categories, the classical or environmental heatstroke observed in passive animals, due to high ambient temperatures, and exertional heatstroke, caused by strenuous physical exercise. The first category is not relevant during long-distance sled dog races, which take place during the winter season on snow-covered surfaces. Problems with heat dissipation and hyperthermia might occur in sled dogs with thick coats during strenuous physical work, even during the winter. Hyperthermia may also occur in running sled dogs, especially if the ambient temperature is above -7 °C, and the snow reflects sun (Grandjean et al., 1998). Mushers have reported that high winter temperatures (around 0 °C) might reduce dogs' willingness to run/pull.

Hypothermia

Decreased core body temperature (hypothermia) is unlikely to occur while sled dogs are running, as muscular activity produces heat, but should be considered when dogs are resting. The risk of hypothermia is higher for dehydrated, sick animals, dogs with poor coat quality, and dogs with low body fat. Data on the frequency of hypothermia in sled dogs are not available.

Low ambient temperatures, wind, and moisture can lead to frostbite in dogs. The most-exposed body parts in sled dogs during races were reported to be the scrotum in males and the nipples in females (Stafford, 2006). Frostbite is common in mushers and sled dogs, but the frequency for sled dogs is not known. On single occasions, frostbites have been observed in dogs with paw injuries at ambient temperatures of -40 °C (Ingrid Wiik Haugbjørg, pers. communication). Some body parts with frostbite may recover.

Harsh weather conditions lead to a higher energy demand from the dog, and it is possible that the caloric and other nutritional needs are not met by feeding due to anorexia.

Summary – weather conditions (high/low ambient temperatures)

According to current sled race regulations in Norway, races can be terminated by the race deputy should environmental conditions be so harsh that they pose a high risk to the welfare of dogs and mushers. Extreme ambient temperatures, combined with either strenuous physical exercise or resting, may be a hazard to animal welfare, especially for exhausted dogs that may not be able to feed enough to replenish energy stores.

2.2.2 Health hazards

2.2.2.1 Emaciation

Data on weight loss in dogs during Norwegian sled races are not available, but weight loss is nevertheless considered as a problem in long-distance sled dog racing (e.g. hearing expert, Annette Kriller). There are several contributing factors. Dogs may be unable to compensate for the increased energy needs by their feed intake. Mushers may have insufficient knowledge about feeding dogs, resulting in improper feeding techniques, timing, and/or

quality of the food. If dogs suffer from diarrhoea, and/or loss of appetite, which may be stress induced, the imbalance of energy may be pronounced. Dehydration may also result in a decrease in weight. Body condition is commonly determined from a standardized scoring system, usually from a numeric scale system, either a 5 point- (Edney and Smith, 1986) or a 9 point system (Laflamme, 1997) Few studies have examined the effect of endurance racing on body condition. Body weight and body conformation have not been associated with whether dogs finish the Iditarod race (Constable et al., 1996). Hinchcliff and colleagues (1998), however, reported that dogs that did not finish the Iditarod lost more weight (9 % vs. 5 %) than dogs that completed the race, and even those that finished lost significant weight during the race.

Reynolds and colleagues (1999) described the ideal body condition in racing sled dogs as "easily palpable ribs and spinous processes, and a slight depression between the wings of the ileum", corresponding to a score of 2.5 on a 1-5 numeric scale. By comparison, this description corresponds to a score of 4 on the 9-point numeric scale (Baldwin et al., 2010).

According to practices at Norwegian races, dogs with BCS below 2 are excluded at the checkpoint. Dogs with dehydration of 7% (Grandjean et al., 1998) or more are excluded from the race

2.2.2.2 Musculoskeletal disorders

Stiffness and lameness are often reported among dogs participating in long-distance races. Rhabdomyolysis should be considered when dogs present with muscle pain, low–grade fever, and dark urine. The classic triad of muscle swelling, tenderness and weakness (common medical problems in marathon runners) is rarely found, especially in the setting of concomitant dehydration.

High levels of the muscle enzyme creatine kinase (CK) are indicative of severe muscle degeneration and, in sled dogs, may represent a degree of muscle breakdown beyond which a dog cannot continue to work. Markedly high serum concentration of CK, and possibly aspartate transaminase, an enzyme important in amino acid metabolism and which is found in the heart, skeletal muscle, liver, kidneys, brain, and red blood cells, may be indicators of performance failure in sled dogs competing in long-distance races (Burr et al., 1997).

Data from human studies indicate that the more an athlete runs during training, the lesser the risk of injury on race day (Caselli and Longobardi, 1997). It is likely that these results are valid also for dogs, but, to our knowledge, commensurate studies have not been conducted. In a recent study by Vlasakova and colleagues (2017), the skeletal troponin I, myosin light chain 3, and creatine kinase muscle isoform (Ckm) were found to be sensitive early tissue biomarkers for monitoring skeletal muscle injury and effects of sustained endurance exercise in dogs. These biomarkers are not yet available for regular veterinary use, as far as we know.

Serum analyses for markers of muscle damage may be helpful for identifying dogs in danger of developing rhabdomyolysis.

Summary – Musculoskeletal disorders

Musculoskeletal disorders occur commonly in long distance racing, and are also a common reason for dogs being excluded from the race. These therefore represent a hazard to animal welfare.

2.2.2.3 Gastrointestinal disorders

Scattered gastric erosions, ulceration, and haemorrhages have been demonstrated in 48-60% of dogs performing single or multiday exercise (Davis et al 2003a, b; 2006; Williamson et al,. 2007;2010). These gastric lesions are often subclinical and have not been correlated with a negative effect on performance (ref). The conditions are related to pain and discomfort in human athletes (de Olivera et al., 2009), and therefore their high prevalence in sled dogs may have significant animal welfare implications. Gastric ulceration may even result in death, either due to development of septic complications or in association with acute or chronic blood loss.

Clinical symptoms, in general, may be non-specific and difficult to interpret. In a multi-dog household, it is challenging to observe vague changes in each dog's general condition, like sporadic vomiting and slightly reduced appetite, symptoms not necessarily indicating disease. However, since vomiting may be an indicator of possible gastritis, it is very important for mushers to register "vomitors" during periods out of racing and in the training season. The prevalence of gastric ulcers in dogs participating in long-distance races in Norway is, as far as we know, not registered.

"Exercise intensity" and other "external" factors may contribute to abdominal pain/discomfort during racing. The amount of fluid and type of feed ingested, as well as environmental factors such as temperature, must be taken into consideration. Hypovolaemia from dehydration exacerbates the low-flow state and increases GI complaints (Rehrer et al., 1990). Hyperthermia is further provoked by dehydration. Other factors that contribute to GI-disorders may be altered blood supply combined with effect of gastric acid, increased stomach acidity associated with high fat diets, and stress-associated prostaglandin suppression (Davis et al., 2016). Whether the high-fat diets routinely used in these types of canine athletes are predisposing factors has not been examined. Medication, possible subclinical hepatic disease, endocrinopathies, etc., may be of importance because of their possible negative influence on the gastric mucosal lining. Observation of severe lesions in dogs attending a specific race one year, and virtually nothing to observe during the same race the following year, tends to reduce the likelihood of individual susceptibility as a major contributing factor (Davis et al., 2016. Finish time, especially when compared with finish time in previous races, will give an idea of the level of exertion during the race (Davis et al., 2016).

There is sparse information regarding pre-race gastric mucosal status, but more studies describing the status post-race (Williamson et al., 2010; Royer et al., 2005, Davis et al., 2003, 2006:, Williamson et al., 2007). Studies looking into possible hormonal and biochemical markers as indicators of predisposing factors, like cortisol, gastrin, and C-reactive protein, have been performed, but their role in the pathophysiology of exercise-induced gastrointestinal disease remains unconfirmed (Fergestad et al., 2016). Pre-race white blood cell (WBC) counts and biochemical serum analysis, as performed during the Iditarod race, and checking for diseases, including diseases predisposing for gastritis, may detect dogs that should be excluded from racing. However, exclusion of more than a few dogs, if any, using this approach seems unlikely.

Diarrhoea is highly prevalent in racing sled dogs, and some of the underlying causes are described below. The composition of the diet, amount of food per meal and also time from eating to exercise, may be of importance for development of diarrhoea. Food intake and exercise should be increased gradually during training season. McKenzie and colleagues (2010) concluded that sled dogs participating in long-distance racing have a high prevalence of diarrhoea and hematochezia that does not seem to be associated with currently identifiable enteropathogens, at least as a single aetiology.

There is a high prevalence of *Salmonella* infection among racing sled dogs, but there is no difference in *Salmonella* occurrence between diarrhoeic and non-diarrhoeic dogs (Cantor et al., 1997). Raw feed contaminated with *Salmonella* may be the cause of this finding, with subsequent passive shedding of the organism (Long, 1993; Finley et al., 2007; Joffe and Schlesinger, 2002; McKenzie et al., 2010). The prevalence of *Salmonella* in the Norwegian sled dog population is, to our knowledge, not registered, but is probably lower than that found from studies in other countries due to the relatively low prevalence of *Salmonella* spp. in Norway. The presence of potentially healthy carriers of *Salmonella* is a problem of significant public health concern, particularly if antibiotic resistant strains are involved. As far as viruses are concerned, a substantial increase in serum titres to canine parvovirus was observed in sled dogs competing in the 2006 Iditarod Trail Race, but clinical disease was not identified (Banse et al., 2008). These findings underscore the risk of exposure to enteropathogens that racing sled dogs encounter. With more open borders between countries and less controls on dog travel, the risk of introducing new infectious agents and /or antibiotic resistant microbiota to our sled dog population has increased.

Exercise-induced gastrointestinal ischemia, due to the redistribution of visceral blood flow, may occur in dogs for which the intensity of exercise exceeds the capacity of the cardiovascular system. The actions of GI hormones and neuropeptides released during exercise, endotoxaemia, mechanical stimulation, or trauma to the bowel from the repetitive impact of running, and exercise-induced alterations of large intestinal motility are proposed aetiologies for gastrointestinal dysfunction (Moses, 2005; Brock.Utne et al., 1988; Gil et al., 1998; McKenzie et al., 2010). Gastrointestinal bleeding, presented as occult bleeding, melena or haematochezia, has been suspected to occur frequently in racing sled dogs, based on a documented decline in haematocrit and serum albumin concentrations and increases in

serum urea nitrogen concentration during races (Davis et al., 2008; McKenzie et al., 2007). Bloody bowel movements after an endurance event should indicate the possibility of ischemic colitis and/or haemorrhagic gastritis. The colon is an important site of inflammation and haemorrhage that are associated with running activity in humans (Moses, 1993; 2005; Sanchez et al., 2006).

Use of nonsteroidal anti-inflammatory drugs (NSAIDs) has been associated with increased GI complaints in dogs, and it is essential to stress the importance of discouragement of using NSAIDs in the pre-race period (Papich, 1993; Johnston and Budsberg, 1997; Johnston and Fox, 1997). It is possible that concurrent administration of NSAIDs could have an additive or synergistic role in promoting gastric disease. However, it should be noted that all studies to date that have demonstrated exercise-induced gastroenteritis in dogs have been done in circumstances in which NSAID use was prohibited (Davis et al., 2003a; 2003b; 2005; Williamson et al., 2010). Thus, NSAIDs appear not to be a necessary component of the pathophysiology of exercise-induced gastroenteritis in dogs (Davis, 2016).

Summary – Gastrointestinal disorders

Gastrointestinal disorders occur commonly in sled dogs during a race and usually seem to have a non-infectious aetiology. It may be difficult to identify dogs at risk before the race starts. Gastric mucosal alterations may occur during the first day. GI-disorders may become severe, and even cause death. The cause/causes of the gastrointestinal disorders affecting dogs during high endurance racing seems to be complex and multifactorial.

2.2.2.4 Dehydration

Dehydration occurs when water intake is insufficient to replace water lost in physiological processes. Endurance sport is a known risk factor for dehydration. Stress can hinder dogs from drinking sufficiently. Even when an animal has access to water and actually drinks, vomiting or diarrhoea may prevent the water ingested from being absorbed.

Clinical signs of dehydration are thirst, increased haematocrit (a larger proportion of red blood cells compared with plasma in a centrifuged blood sample), sunken eyes, reduced elasticity of the skin, little and concentrated urine, and loss of appetite. Dehydration in humans causes headache and a feeling of discomfort, tiredness, dizziness, and often confusion. Large and rapid reductions in the water content of the body cause arterial blood pressure to fall, tachycardia (rapid heart rate), and reduced blood perfusion of body tissues. Fainting and seizures may occur. In humans, a 5-8% loss of body water will cause fatigue and dizziness, 10% will cause severe thirst and physical and mental deterioration, and 15-20 % loss of body water is fatal.

Hyponatraemia is a potentially serious, electrolyte–related consequence of marathon racing in humans (American College of Sports Medicine et al., 2000). The symptoms of hyponatraemia can range from cramping, dizziness, and weakness to seizures, altered mental status, cerebral and pulmonary oedema, coma, and death. This has also been

described in horses (Schott et al., 1997). Hyponatraemia without associated clinical signs has been reported in dogs competing in the 1,100-mile Iditarod Trail sled dog race and in dogs competing in shorter races (Hinchcliff et al., 1997a).

Hyponatraemia develops during prolonged exercise by sled dogs and is associated with large water turnover, renal sodium retention, and high urine osmolality. The high water turnover of Alaskan sled dogs during a race appears to be related to their large metabolizable energy intake and, hence, large renal solute load. It has been speculated that exercise-associated hyponatraemia in sled dogs is a result of loss of sodium in urine combined with inadequate intake of sodium. However, an abnormality in regulation of extracellular fluid volume cannot be excluded as contributing to the hyponatraemia (Hinchcliff et al., 1997b). In a study by Ermon and colleagues (2014), it was suggested that consumption of approximately 0·9 g/kg 0·75 (1·2 g/4184 kJ) of sodium per day may prevent exercise-induced decreases in sodium and potassium.

Summary – Dehydration

Dehydration is a well-known risk for sled dogs. It is usually a consequence of vomiting and/or diarrhea, but may even occur in dogs that are less motivated to drink when offered water.

2.2.2.5 Insufficient rest

During a race, obligatory resting times are set by the race rules, and, in many cases, part of this rest must be taken at defined checkpoints. Both the short-term and long-term consequences of the amount of rest (time spent resting), the timing of rest (whether the rest is related to the tiredness and daily rhythm of the animal), and the quality of rest (i.e., level of disturbance during rest or protection from harsh environmental conditions, such as cold), can be considered in evaluating welfare of animals.

The obligatory resting times set by the different race guidelines are below the minimum of 10 hours rest needed a day. Mushers allow longer resting time for their dogs, than the obligatory resting times set by the race rules. The time spent actively racing and resting for each completed race at both Femundløpet and Finnmarksløpet is published on the websites. Data show that for the longest two categories, Femundløpet 600 and Finnmarksløpet 1000, sled dogs rested well above the obligatory time (Table 3).

	Racing (hours)				Resting (hours)				
	Winner	Mean	Min	Max	Winner	Mean	Min	Max	Obligatory
Finnmarksløpet 1000 (2016)	85.7	93.1	84.3	102.1	58.9	70.3	58.2	86.5	29
Finnmarksløpet 500 (2016)	42.9	49.9	41.8	76.0	22.5	30.4	22.1	54.1	22
Femundløpet 600 (2017)	43.7	48.2	42.0	63.2	23.4	32.9	20.8	52.1	20
Femundløpet 400 (2017)	25.7	30.4	25.4	60.4	13.4	18.9	12.4	34.5	12

Table 3. Amount of hours spent actively racing, resting (time of winner, mean, minimum, maximum of times of sleds completed the race) and obligatory resting times (in hours) for Finnmarksløpet 1000 and 500 km (in 2016) and Femundløpet 600 and 400 (in 2017), respectively. Results obtained from finnmarkslopet.no and femundlopet.no.

Both these data, the opinion of hearing experts, and guidelines from the NSDRA indicate that mushers must evaluate the needs of their dogs during the race and base their decision or resting on their dogs' physiological states, and rest accordingly. Tired dogs do not pull efficiently and may even stop and refuse to run, sometimes referred to as "parking". Therefore, experienced mushers adjust the resting periods according to circumstances.

Some mushers reported that on warm days they might prefer to race during the cooler nights, thereby protecting the dogs from hyperthermia. However, this means that the dogs will not be following their normal daily pattern of resting during the race period. Dogs show high variability in their timing of rest, flexibly adjusting their resting pattern to the environment. Therefore, resting occurring at a different pattern from the usual situation is not considered as a hazard.

Disturbances during resting (e.g. dog barks, other sleds passing) can contribute to fragmented rest and, therefore, to less efficient recovery. Some mushers report that resting at checkpoints is not optimal due to disturbances. According to the mushers, resting outside busy checkpoints would be preferable. Currently, all obligatory rest stops must be taken at checkpoints, probably partly with the aim of obtaining a better overview of the health status of the animals. If this is the case, then the health check and the need for undisturbed rest may conflict with each other.

There is a considerable short-term consequence of sleep suppression on the physiology of animals. Sleep suppression (combined with fatigue) increases the risk of many medical problems seen in sled dogs during races (e.g. circulatory events, diarrhoea, hypothermia).

Data on the reasons for dogs not finishing a race or reasons for removal of some dogs from a race are not published, so it is not possible to evaluate the extent to which sleep deprivation may contribute to pathological cases.

Summary – insufficient rest

Sled dogs participating in long-distance races may experience sleep suppression, which can compromise their welfare. These effects may be temporary, but adequate data are lacking

2.2.3 Other health hazards related to sled dog racing

Respiratory disorders

Aspiration pneumonia is often associated with gastrointestinal complaints for which vomiting and/or regurgitation are common clinical signs. Aspiration of gastric contents is recognized as an unexpected death event and was documented in 8 of 23 unexpected deaths in the Iditarod races between 1994-2006. Gastric lesions were present in all of these dogs (Dennis et al., 2008).

As in human medicine, veterinarians cannot exclude an effect of exercise-induced asthma on performance, especially when exercising in cold conditions. This is often termed "ski asthma" in humans, since cross-country skiers are affected most prominently. Human athletes generally do not have demonstrable allergies or other sources of airway inflammation, leading to the hypothesis that the exercise itself may cause the entire syndrome, and not merely be an exacerbation of a pre-existing syndrome. It is reasonable to conclude that dogs participating in strenuous cold weather activities may also be more susceptible to secondary pulmonary infections, assuming that: 1) such activities damage the respiratory mucosa, and 2) such damage facilitates bacterial colonization of the lower airways (Davis et al., 2002). Knowledge of and alertness to early clinical signs of pulmonary disease may enhance treatment success.

Cardiac failure/death

Sudden death, most often due to cardiac events, sometimes occurs in human marathon runners (Redelmeier and Greenwald, 2007), and has also been observed among sled dogs (Dennis et al., 2008). There will always be a risk for sudden death due to heart failure, and extreme exercise may reveal underlying congenital or acquired heart disease. ECG is already a part of the pre-race examination for Iditarod, but race veterinarians should be able to recognize cardiac arrhythmia, murmurs, and signs of circulatory disturbances during the pre-race clinical examination. However, these symptoms may be presented intermittently in some animals, and therefore difficult to observe. Analysis for serum cardiac markers as troponin I may increase the possibility of identifying and excluding dogs suffering from subclinical myocardial injury and at risk of heart failure (Langhorn and Willesen, 2016).

Mathews and colleagues (2012) examined the mortality rate among marathon runners in the United States, 2000-2009. Their conclusion was that participation in marathons has increased without any change in mortality or average overall performance during this period. Their results do not support pre-marathon screening to prevent death given the low/stable mortality, lack of criteria for predicting death, and potential costs of screening the large number of low risk participants. This conclusion is of relevance in the discussion of the components of pre-race screening in sled dog racing.

Summary – Respiratory disorders, cardiac failure

Aspiration pneumonia may occur during racing, due to aspiration of vomit. Sudden death due to cardiac events has been observed among sled dogs, but may be very difficult to foresee by clinical and ECG examination prior to the race. Exercise-induced asthma may also be a problem due to inhalation of cold air.

2.3 Summary of hazard identification

Based on our present knowledge, the following factors were recognized as hazards to animal health and welfare within the scope of Terms of Reference.

Outdoor housing

- Weather conditions
- Insufficient shelter
- Insufficient human contact
- Contagious diseases and parasites (dogs housed in large holdings)
- Social isolation stress if tethered or housed alone
- Social stress in large crowded groups
- Restricted space when tethered or housed in small pens
- Lack of exercise

Long-distance sled dog racing

- GI-disorders
- Musculoskeletal disorders/lameness
- Insufficient rest
- Death/cardiac failure
- Emaciation
- Dehydration
- Respiratory disorders
- Weather conditions

3 Risk characterisation

The risk of reduced welfare is defined as the probability that a hazard will cause welfare reduction, multiplied by the degree of consequence of this welfare reduction.

In this assessment, the project group has chosen a three-grade scale concerning probabilities and consequences. The term «dogs» refers to the relevant part of the dog population, i.e. dogs kept permanently outdoors or used for long-distance sled dog racing. Numbers are estimated.

- Low probability: <1 % dogs will experience reduced welfare
- Moderate probability: 1 – 10 % dogs will experience reduced welfare
- High probability: >10 % of dogs will experience reduced welfare

- Limited consequence: No or limited consequence for animal welfare
- Moderate consequence: Moderate consequence for animal welfare
- Serious consequence: Serious consequence for animal welfare

In the following risk charts of this chapter, different levels of risk are symbolised as follows:

- Low risk: Green
- Moderate risk: Yellow
- High risk: Red

Evaluating the effects of outdoor housing of dogs on welfare is problematic, since many factors interact and influence most of the identified hazards. The working group has therefore chosen to focus on performing a risk estimation on long-distance sled dog racing (Figure 3-1). Risks relating to outdoor housing are addressed directly in the section Answers to the Terms of references.

Consequence	Probability: Low	Probability: Moderate	Probability: High
Serious	Cardiac failure/death Hyperthermia during resting Hyperthermia during running	Hypothermia during resting	
Moderate	Hypothermia during running	Dehydration* Respiratory disorders*	GI-disorders Musculoskeletal disorders* Insufficient rest
Limited			Emaciation

Figure 3-1. Risk estimates related to long-distance sled dog racing. The asterisk* indicates that the severity of the condition may vary from mild to fatal, preventing a more precise estimation of risk.

4 Uncertainties

In this risk assessment, a number of uncertainties related to either outdoor housing of dogs or long-distance sled dog racing have been identified.

Uncertainties related to outdoor housing of dogs

Information on factors that influence thermoregulation in dogs is limited. Canine thermoregulation is influenced by various climatic and individual factors, not just ambient temperature and determining those temperatures that represent a risk of reduced welfare for polar dogs or mixed breeds is therefore difficult. Data on LCT vary with dog breed and individual circumstances and cannot be generalized.

Dogs are more likely to be exposed to infectious agents (viruses, bacteria, or parasites) when kept in larger groups. The severity of health problems depends on the infectious agent and medical treatment/preventive measures provided by the owner. The risk of reduced welfare resulting from social stress is difficult to quantify, as the relevant factors such as handler skills, domestication history, life experience, or retreat opportunities, are not easily quantifiable.

To our knowledge, studies of dog welfare comparing permanent tethering with pen housing are lacking. Scientific publications on the effects of different housing types on the welfare of pet dogs, family dogs, or working dogs are also scarce.

Uncertainties related to long-distance sled dog racing

Nutritional status is commonly evaluated in dogs using BCS to determine whether they are overweight or obese. Weight loss in dogs during races is poorly documented.

Currently it is difficult, if not impossible, to identify dogs at risk of gastric ulcers. We know that sled dogs may suffer from gastritis, gastric erosions, and, possibly, ulcers, without showing any sign of illness. Some mushers use prophylactic treatment to reduce the risk, while other dogs apparently do not suffer from gastric problems even without medication. However, medical prophylaxis of gastric ulcers is documented as being effective. Side-effects from prophylactic medication may occur, but their extent is not known. As ulcerations seem to develop during the first day(s) of a race, avoidance of longer races may not affect the likelihood of ulcerations occurring. Whether medical prophylaxis of dogs participating in races should be allowed (be prohibited, encouraged, or be mandatory) is an ethical question, which is beyond the scope of report.

Our knowledge on the underlying causes of many health-problems seen in sled dog races, to date, is based on relatively few scientific publications. The number of dogs included in research studies is often relatively low, and there are many practical problems for conducting clinical observational investigations (such as endoscopy, bronchoscopy etc.), during a race.

5 Risk-reduction measures

Outdoor housing

Temperature tolerance

Provision of resources to help dogs' thermoregulation will reduce the risk of reduced welfare due to extreme temperatures. These include:

- Access to shelter with covered entrance and eventually insulated and/or with heating under very cold conditions
- Dry and well insulated bedding
- Access to adequate drinking water (not frozen)
- Adequate fur coat quality and body conditions score (BCS)
- Provision of protective coating

Prevention and treatment of diseases in large groups of dogs

Risk-reducing measures include performing regular veterinary services with a protocol for clinical examinations, vaccination, and using parasite-control measures. The risk of disease can be reduced by:

- Cleaning and disinfecting both indoor and outdoor areas regularly and daily removal of faeces.
- Good feed hygiene.

Reducing stress in large groups of dogs

The following measures may reduce stress:

- Good management with supervision and careful group composition.
- Regular training, i.e, physical and/or mental stimulation.
- Avoiding competition for important resources by providing:
    - Individual resting places.
    - Individual feeding bowls.
    - Supervision during feeding.
    - Sufficient amount of water.
    - Enough shelter.
- Selecting dogs that get along well together and removing potential troublemakers from the group.
- Appropriate early socialization (ample social experience from young age)
- Careful, step-by-step introduction of new individuals
- Enough space, possibility to withdraw from agonistic interaction (e.g., secluded areas in environment, different partitions, and elevations).

Management of outdoor housing

Both tethering and pen-housing of dogs may compromise welfare of animals, as both methods restrict the space and amount of stimulation for dogs, thus not allowing expression of their natural behaviour repertoire, as required by the Animal Welfare Act. These effects may be counteracted to some extent by different management practices such as:

- Providing physical exercise (training, running, walking) multiple times a day.
- Social opportunities (e.g., pen mates, visits from humans, training with humans, play with other dogs, visual contact with other dogs).
- Environmental enrichments, like toys, mental exercises, training,
- Habituation to human environments e.g. visits to the house, walks to new environments e.g. to the city, travelling by car.

The degree of coping of dogs when tethered or housed in pens depends on management routines, the experience of the handler and the individual dogs.

Long-distance sled dog racing

Extreme weather conditions

According to the present sled race regulations in Norway, sled races can be terminated by the race deputy should environmental conditions be so harsh that they pose a high risk to the welfare of dogs and mushers. Some of the environmental risks can be reduced by:

- Adjusting the strategy of running (e.g. running at night if daytime temperatures are high, running slower or faster, shorter distances with more stops or longer distances with fewer but longer stops).
- Providing protection to the dogs (e.g. adequate insulation while resting, blankets, protective furred clothes, booties).

Compulsory veterinary control

Well-experienced veterinarians at checkpoints will increase the chance of discovering unfit dogs and dogs at risk of becoming ill/suffering.

ECG examination is performed pre-race in Iditarod. This may identify individuals at risk, but a single examination may also give false-negative results. As cardiac arrhythmia may be intermittent, multiple examinations at every checkpoint might be needed, which is not feasible.

Taking blood samples can also be considered for monitoring hydration status. Until reliable biomarkers are available, however, this measure is of limited use. Blood analyses should be considered as part of the pre-race examination and during the race for monitoring hydration status in dogs suspected not capable of continuing the race

When reliable biomarkers for different diseases, like muscle / cardiac disorders are available, blood analyses will become more useful.

As far as mushers are concerned, competence in dog behaviour, health and welfare and ability to identify dogs that may suffer during keeping, training, transport or racing, could reduce welfare risks. Screening of dogs that are intended to participate in a race early on during training may reveal dogs that are not fit and at risk of disease and/or suffering during training and racing.

More consistent use of body condition scoring systems will be helpful.

Non-medical prophylaxis of diarrhoea/vomiting

Risk-reducing measures include proper feeding and hydration, sufficient rest, avoiding pushing the dog's limits, minimizing stressful situations.

6 Conclusions (with answers to the terms of reference)

Outdoor housing of dogs

1.1 Thermoregulation:

Sled dogs like Alaskan Huskies are often a cross between polar dogs and other, less densely coated dogs, such that their coats vary.

a. Which temperatures represent a risk of reduced welfare for polar dogs such as Greenland Dog and Alaskan Malamute?

Pure polar breeds, such as the Greenland dog, may cope with an ambient temperature as low as -25°C. However, the literature on LCT for canine breeds is limited, preventing a complete risk assessment. Moreover, heat loss by convection might be more important than radiation, so ambient temperature and wind should be considered together.

The temperature tolerance observed in polar dogs does not apply to mixed breeds, due to variability in the thickness and structure of insulating fur. Factors such as fur coat, body condition, feeding, metabolism, age, health status of animal and habituation also affect thermoregulation in dogs. Other climatic factors, e.g. sunshine, snow coverage, rain, and environment, like shelter access, also have substantial effect on coping in thermoregulatory challenging situations.

With regards to higher ambient temperature limits of temperature tolerance in polar dogs, knowledge is lacking.

The risk of reduced welfare may be alleviated if dog owners are able to recognise signs of thermal discomfort in their dogs.

b. What type and quality of coat should a dog possess as regards topcoat, undercoat, and amount of hair on the chest, belly, genitals etc. in order to be suited for outdoor housing as described introductorily?

To be suited for outdoor housing, the dog should have thick woolly undercoat and a topcoat that prevents precipitation (rain, wet floor) soaking through to the undercoat. Ideally, all parts of the body should be well covered by fur. Nevertheless, exposed body parts like belly and genitals are usually well protected when the dog rests in a curled position on an insulated and dry surface. Exposed body parts can be also be protected by providing dogs with protective clothing, such as coats. Access to shelter

especially if insulated, can alleviate demands for extremely thick coat when housing dogs outside.

c. How do other factors, such as age, health, and body condition, affect the risk of reduced welfare when dogs are housed outdoors?

Adult dogs have better thermoregulatory ability than puppies or old dogs. Heat production may be less efficient in old dogs, due to reduced metabolic rate. Old dogs are also more prone to developing musculoskeletal disorders, which causes stiffness and pain, when exposed to cold weather. Diseases also reduce heat production and lower BCS, resulting in increased heat loss, and hence may contribute to reduced animal welfare. All these factors interact and are also dependent on what type of shelter (i.e. bedding type and insulation/no insulation) dogs have access to. Estimating the risks of reduced welfare is therefore difficult, it may vary from moderate to high, depending on which factors are taken into account. Nevertheless, by taking all these factors into consideration, and applying the risk reducing measures given below, will alleviate the risk.

Housing dogs outdoors during summer days, when ambient temperatures are high, may increase the risk of reduced welfare due to hyperthermia. This applies especially to dogs with a dense coat, dark colour, dogs with a high BCS, dogs with a brachycephalic head shape, and also old and sick individuals. Appropriate management, e.g. ensuring access to shade and drinking water, and restricting hard physical training, is important to avoid development of hyperthermia.

d. What measures for risk reduction could be applied?

It is important that dogs housed outdoors are provided with sufficient resources to aid with thermoregulation ability. The following measures could be applied for risk reduction:

- Access to a house or shelter that protects the dog from wind, precipitation, and heat loss by radiation to a clear sky. The house/shelter should be insulated, with the possibility to cover the entrance.
- Use of protective coats or blankets that cover exposed body parts or the entire body.
- A special concern for old, very young, or sick animals, with alternative heated housing
- Access to a thick layer of clean dry bedding, e.g., straw, on the resting surface will reduce heat loss to the ground, and hence increase the tolerance for low temperatures.
- Ensure that dogs are fed sufficiently and with high quality feed.
- During summer, it is important to provide dogs with shaded areas for cooling and unrestricted drinking water.

1.2 Keeping of dogs in large groups:

a. What is the risk of reduced welfare resulting from health problems when dogs are kept in large dog holdings? How should routines for prevention and treatment of illness be in order to reduce the risk?

Keeping dogs in large groups (i.e., large dog holdings, irrespective of whether tethered or kept in kennels) will increase the risk of exposing them to pathogenic agents. Puppies, as well as old/young dogs, are particularly vulnerable. However, assigning a specific risk is not possible as many factors are involved. As the severity of these health problems depends on the infectious agent and measures taken by the owner, consequences may vary from limited to serious. The number of dogs being kept, the physical direct and indirect contact between them, and the frequency of contact with dogs from other premises, i.e. participating at competitions or exhibitions, should also be taken into account.

Routines for prevention of infection include:

- Daily removal of faeces
- Regular cleaning and disinfection of premises and equipment
- Ensuring hygienic drinking water and high feed quality
- Regular veterinary health control and protocols for vaccination
- Parasite prophylaxis (particularly for new dogs joining the facility).

b. What is the risk of reduced welfare due to social stress when dogs are kept in large groups? What measures for risk reduction could be applied?

In a carefully selected and managed group of dogs with stable hierarchies, physical conflicts can be avoided. Possible social stress in group pens is usually outcompeted by the beneficial effects of improved social life, compared with single housing (in pens or tethered). The following measures could be applied to reduce the risks of social stress:

- Provide the dogs with opportunities for proper socialization; e.g. earlier experience with housing in groups, experience with the group members before forming the actual groups.
- Provide the dogs with opportunities to withdraw from social conflicts (enough space, shelter, barriers, complex environment).
- Providing dogs with their own dog houses, feeding bowls, and resting places to reduce the opportunity of monopolization of key resources.
- Monitor the dogs for behaviour and health twice a day. Remove and treat sick, injured, or harassed (or harassing) individuals. By maintaining a consistent and regular observation of individual relationships, the group may be managed for optimal interactions, e.g. dogs may be replaced in order to form better group structure and reduce frustration in animals

1.3 Housing method:

According to the Animal Welfare Act, animals shall be kept in an environment which is consistent with good welfare, and which meets the animals' needs, both species-specific and individual. The environment shall give the animals opportunity to carry out stimulating activities, movement, rest and other natural behaviour. The animals' living environment shall stimulate good health and condition, and contribute to safety and wellbeing. Animals shall have access to suitable and safe shelter outside the normal grazing periods (§ 23). Furthermore, management methods, equipment and technical solutions which are applied to animals are suitable for the purpose of ensuring the animals' welfare (§ 8).

a. What is the risk of the requirements, as stated in the Animal Welfare Act not being met, resulting in reduced animal welfare, when dogs are housed permanently outdoors, in pens or tethered?

Both tethering and housing of dogs in pens restrict the space and amount of stimulation for dogs. To our knowledge, there is no scientific documentation available comparing the effects of tethering versus pen-housing. The degree of coping of dogs when using either housing methods depends on the size of the pens, management routines, the experience of the handler, and the individual dogs. Thus, the risk of reduced welfare varies, depending on availability of space (whether penned or tethered), management/experience, and individual dogs. A large pen containing dogs that get on well together is probably a good basis for fulfilling the requirements of §23.

b. What measures for risk reduction could be applied?

The practice of tethering or housing in small pens can compromise animal welfare, which may be observed in dogs that display boredom, overexcitement, or restricted behavioural patterns (stereotypies). The risk can be reduced by different management practices, such as:

- Providing mental and physical exercise (training, running, walking).
- Social opportunities (e.g. play with other dogs, visual contact with other dogs, visits from humans, training with human).
- Environmental enrichment (e.g. toys, mental training).
- Ensuring adequate space, and fulfilling requirements for good health and safety.

Long-distance sled dog races

2.1 Which indicators are suitable to identify dogs before the race that are at particular risk of being subjected to unnecessary stress and strains, such as strain injuries, illness, exhaustion and death?

There are currently no fail-safe indicators that can be used to identify dogs at risk of being subjected to unnecessary stress and strains pre-race. Standard clinical examinations, along with monitoring BCS, and checking for sporadic vomiting, diarrhoea, lameness, and recurring cough reduces the risk.

Reduced appetite and sporadic vomiting during off-season do not necessarily indicate disease. However, those mushers who pay extra attention to these individuals to rule out possible underlying diseases, will reduce the welfare risk.

Biochemical serum analyses and haematological evaluation may provide some information regarding the animals' clinical status, as done in Iditarod. However, this approach is not very practical, and the cost-effectiveness of such sampling is also questionable. Normal results from such analyses do not guarantee that the dog is healthy. Data on how many dogs not allowed to start a race based on such analyses are lacking.

Research on biomarkers of cardiac disease are ongoing. Early biomarkers for detecting skeletal muscle injuries or cardiac disease may become applicable in the future, and may be of practical use in the health control of sled dogs, both pre-race check and during the race.

2.2 Would e.g. compulsory veterinary control before entering the race or increased number of compulsory veterinary controls during the race be suitable measures for risk reduction?

Identifying dogs that are at risk of being subjected to unnecessary stress, strains and/or illness pre-race is important. However, clear and robust indicators are lacking. Qualifications and experience of the attending race veterinarian are of particular importance for this risk reduction. Setting a higher minimum pre-race BCS, using either the 5- or 9 score numerical scale, for dogs is also worth considering as a risk-reducing measure.

A better system for recording and archiving events at the races could be considered as a possible measure for risk reduction.

2.3 Which indicators are suitable when assessing the total strain on a dog participating in a long-distance sled dog race? Examples include percentage of weight loss during the race, lameness, hydration status, pulse rate, voluntary

intake of feed and water, voluntary start-up after resting, cold injuries, diarrhoea/ vomiting symptoms.

Identifying dogs that are at risk of being subjected to strain-related injuries, exhaustion, or suffering from subclinical diseases during a race is difficult. Clinical symptoms of severe disease may not be obvious, neither before, during, nor immediately after completion of the race. Nevertheless, the factors mentioned in the question are all relevant, as is measuring changes in body weight and monitoring BCS and the occurrence of frostbite. Many of these factors are already included in the checklists. Voluntary start-up after rest is a relatively new rule, which is important for the welfare of participating dogs.

Dogs with anorexia or severe diarrhoea could be at risk of dehydration or gastrointestinal dysfunction, and may thus be at increased risk of reduced welfare if continuing the race. Dehydration can be determined by clinical examination of parameters such as appearance, eyes, mucous membranes, and skin turgor.

Increases in respiratory rate, excessive respiration, rapid heart rate, and bright-red gingiva are all worth paying attention to, as these may indicate imminent hyperthermia.

Dogs that are pushed too far may respond by "parking" (a mental state, recognised by lack of responsiveness and/or refusal to run), which is commonly seen in long-distance sled dog racing in Norway. It is important that mushers know their dog's limit, preferably before the race. The habit of borrowing dogs from other owners makes it more difficult for the musher to recognise early signs of this mental state as well as other early signs of disease problems.

Dogs could be checked for fatigue and lameness immediately upon arrival at checkpoints and then again after some rest when leaving the checkpoint; the latter results could have more stringent acceptance levels. Signs of fatigue may be masked if evaluated after rest and when dogs are attached to the sled ready to work. As excitement is contagious and the situation is learned, signs of fatigue and disorders may be masked. Veterinary checks before the dogs are attached to the sled may reduce the welfare risk.

Dogs demonstrating repeated vomiting during a race have an increased risk of aspiration pneumonia, may not get the required energy intake, and may develop more severe GI-disorders and dehydration.

2.4 Today, organisers require a compulsory resting period that is insufficient for the vast majority of the participating dogs, and it is up to the dog handler to ensure that their dogs get sufficient rest. How long and how often should dogs in long-distance sled dog races rest in order to avoid risk of reduced welfare due to insufficient recovery during the race?

The current obligatory resting times set by the different race guidelines are not sufficient for recovery. In fact, the total amount of time spent resting among winners has been reported to be nearly twice the amount of minimum time requirement. Experiences in the past have shown that mushers with dogs that run faster and have more rest also tend to win the race more frequently, as compared with those that run more slowly. Increasing the obligatory resting time, starting with 10 h per 24 h period (which is the minimum biological requirement in dogs) and adjusting upwards, will decrease the risk of reduced welfare.

Based on the opinions of the hearing experts, on the guidelines of NSDRA, and on data published for Femundløpet 600 and Finnmarksløpet 1000, it is advantageous if the mushers adjust the duration and frequency of resting to meet the needs of their dogs. Furthermore, it is reported that mushers would prefer to rest their dogs at other places than the checkpoints, to avoid disturbances, and that a more flexible system would make it easier to stop when the dogs need to rest. Equipping participants with GPS loggers that record the total resting time, and otherwise let participants decide on where and how long rest periods may help mushers to better adjust resting hours to meet the needs of their dogs.

2.5 The level of challenge in long-distance sled dog races is significantly affected by weather conditions. Most participating dogs do not have a coat corresponding to that of the polar breeds, and may be subjected to frostbite. Again, traditional polar breeds may have problems when exercised at too high temperatures. Which temperature limits, also in relation to weather conditions, could be determined in order to reduce the risk of dogs being subjected to strains from heat or cold, thereby resulting in reduced welfare?

Determining specific temperature limits is not possible, due to lack of knowledge on this subject. Low ambient temperatures do not generally represent a problem while dogs are running. However, extreme weather conditions may occur. Certain body parts, like the scrotum and nipples, are exposed to frostbite, and may need protection by the use of man-made coats. Injuries, such as bleeding paws, may result in frostbite if left untreated. Dehydration, sickness, poor hair coat quality and low body condition score increase the probability of dogs developing hypothermia.

High ambient temperatures during winter may represent a problem, especially for dogs with a thick fur coat and high BCS. Development of hyperthermia can occur at temperatures above -7 °C. Mushers have also reported that dogs may become less willing to run/pull when winter temperatures reach around 0 °C.

2.6 Organisers recommend that all participating dogs are given antacids before and during the race to avoid gastric ulcers.

a. What is the risk that such prophylactic medical treatment for gastric ulcers masks clinical symptoms resulting from the dog being subjected to excessive physical and/or mental strains?

There is low probability that prophylactic medical treatment will mask clinical symptoms of gastric ulceration, because the treatment reduces the occurrence of this condition.

b. What are the most important non-medical risk-reduction measures in order to avoid development of gastric ulcers when dogs are trained and used for long-distance sled dog races?

Since gastric ulcers are often exercise-induced, it is important that mushers do not push the dogs beyond their limits. Longer and/or more frequent resting periods, along with provision of feed and sufficient drinking water, can reduce the risk of reduced welfare due to gastric ulceration.

However, research has demonstrated that the ulcers often appear during the first day of exercise.

Use of feed additives to prevent and treat gastric ulceration, which is common for horses, may be worth investigating for dogs.

2.7 What are the most important non-medical risk-reduction measures in order to avoid occurrence of diarrhoea/vomiting when dogs are trained and used for long-distance sled dog races?

See answer 2.6 b.

Additional non-medical risk-reducing measures include:

- Knowing the dogs well so that signs of problems can be identified early.
- Thorough preparations off-season that includes training dogs to learn to re-hydrate during exercises, although this is acknowledged as being difficult.
- Providing dogs with sufficient high-quality feed.

7 Data gaps

At the present level of knowledge, a number of data gaps remain, including:

- Scientific documentation on effects of housing on pet-, family, or working dogs is scarce.
- There is a lack of information on the welfare with regards to tethering and pen-housing of dogs
- Information on lower ambient temperature limits, including weather conditions, in relation to sled dogs is not available. Scientific data on thermoregulation in dogs is scarce.
- It is unknown whether increased amounts of exercise in dogs reduces the risk of skeletal muscle injuries, as reported from human studies. Reliable indicators of disorders, such as rhabdomyolysis, have not yet been identified.
- Relatively little information on pre-race gastric mucosal status is available, as opposed to post-race.
- Studies on the effects of insufficient rest in sled dogs during race are lacking. Larger studies on prevalence of diseases/disorders during and after sled dograces, including dogs that are retired during a race, are required.

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Appendix I

Body condition score (BCS)

Body condition is part of the health assessment of dogs in general, and may be crucial in long-distance sled dogs given the strenuous exercises they are expected to perform and the difficulties with fulfilling energetic needs due to variation in eating and digestive problems during the race. The nutrition of sled dogs during training and race is a whole field of science, in addition to being a hot topic among trainers, and will not be focused upon in this report. This section reviews methods of assessing physical health, in particular weight, body and muscle condition as possible welfare indicators in sled dogs.

Energetic needs

Energetic need depends on age of the animal, breed, body weight (W), ambient temperature and exercise (Hill, 1998). Although sled dogs are normally a mix of several breeds and constitute a heterogeneous population in terms of, e.g. coat, they are assumed to have a basic energy need comparable to most medium-sized dog breeds at thermoneutral environments (500-550 *$W^{0.75}$kJ/day * (Durrer and Hannon, 1962; Finke, 1991)), but even during resting, this value can increase substantially if exposed to wind chill still in the lower threshold of thermoneutral zone (at -20 ^{o}C about 800 *$W^{0.75}$kJ/day (Campbell and Donaldson, 1981; Durrer and Hannon, 1962; Hill, 1998)). During exercise, especially during a long-distance race, energy need was found to be independent of the speed of running, depending more on the distance travelled. In a study, sled dogs needed an average of 4200$W^{0.75}$ kJ/day during a 3-day race at ambient temperatures of -10 to -35°C (Hill, 1998).

Body weight loss during race

As the energetic needs are dependent on multiple factors and energy intake also depends to large extent on the dog's ability to effectively digest and use food, it is not surprising, that some dogs lose weight, especially when terrain elevations are higher, the load of the sled is greater, the temperature is lower and the wind chill is larger (Loftus et al., 2014).

Body condition scoring

In the guidelines of the World Small Animal Veterinary Association (WSAVA) (WSAVA Nutritional Assessment Guidelines Task Force Members: et al., 2011), five vital signs are listed as part of the standard physical examination for small animals, for which the newly added item is nutrition.

The most common method of assessing physical nutritional status of dogs is assessing its body condition by assigning a body condition score (BCS). There are several different systems used to assess BCS in dogs, and scores may range from 4 to 9 values in the different scoring systems. The mostly used and referred to by the WSAVA (WSAVA, 2013;

WSAVA Nutritional Assessment Guidelines Task Force Members: et al., 2011), and the American Animal Hospital Association (AAHA). Edney and Smith (1986) developed and validated the 9-score numeric system about 30 years ago, later modified by (Laflamme, 1997), and is based on visual examination and palpation of four body regions. Scores range 1-9, where 1-3 is regarded as under ideal, 5 is ideal, and 7-9 over ideal in normal pet practices (Edney and Smith, 1986). This scoring system showed both intra-rater and inter-rater reliability, was reported to be useful and reliable even with minimal training, and shows high correlation with body fat values as measured by dual-energy x-ray absorptiometry (DEXA), which regarded as the gold standard for measurement of body fat in dogs (German et al., 2010, 2006; Laflamme, 1997; Mawby et al., 2004). The scoring system is mostly used to identify overweight, obese dogs (e.g. (Chandler and Gunn-Moore, 2004; German et al., 2010; Lund et al., 2006)) and there are some indications, that the same BCS assigned to female dogs is associated with higher body fat content compared to males with the same score (Laflamme, 1997).

Another reported attempt to develop a standardized method for assessing body condition in a cost-effective way is the use of bioimpedance monitor, which is a portable electronic device to measure body fat (Ban et al., 2009; German et al., 2010). This method showed poorer correlation with values obtained with the DEXA method (compared to the body condition scoring correlation) and values were highly affected by the position of the dog during sampling (German et al., 2010).

Another initiative was taken by WALTHAM, which produced its own body condition scoring system with the name S.H.A.P.E. (Size, Health And Physical Evaluation) with the aim of creating a tool that is easier to administer by owners without any face-to-face training or experience (German et al., 2006). This evaluation system assigns dogs into one of seven categories (from A, underweight, to G, obese) and was found to show good correlation between scores given by two independent experienced raters, between an experienced rater and owner, and with body fat measured by DEXA method (German et al., 2006).

Alternatively, simple morphological measurements and calculation of body mass index (BMI) and body fat content can be as reliable as the DEXA method in dogs (Mawby et al., 2004).

Muscle condition scoring

Both WSAVA and AAHA note that body condition in itself may not truly indicate health in dogs, as muscle condition can be independent from body condition (Baldwin et al., 2010; WSAVA Nutritional Assessment Guidelines Task Force Members: et al., 2011). Although both associations recommend scoring of muscle mass, to our knowledge, such an index has not been validated in dogs so far. Development of a feline muscle mass scoring method has been reported, with suggestions for further modifications (Michel et al., 2011) and both main associations have guidelines for evaluating muscle mass in dogs (Baldwin et al., 2010; WSAVA Global Nutrition Committee, 2013; WSAVA Nutritional Assessment Guidelines Task Force Members: et al., 2011).

Appendix II

Summary of output from meeting with hearing experts

In early phase of the risk assessment work, the Norwegian Scientific Committee for Food Safety (VKM) invited mushers and race veterinarians, who are/have been active in sled dog racing in Norway, to a meeting to present their views and experiences on topics or problems associated with long-distance sled dog racing. Prior to this meeting, which was held April 26th 2016 at VKM's office, a list of questions was sent out to all by email.

The following hearing experts attended the meeting:

- Thomas Wærner, active musher
- Petter Jahnsen, active musher
- Arnt Ola Skjerve, active musher
- Annette Kriller, chief veterinarian (via Skype)
- Hanna Fredriksen, chief veterinarian and former musher (via Skype)
- Ingrid Wiik Haugbjørg, chief veterinarian and former musher
- Arild Jøssund, chief veterinarian
- Charlotte Leschbrandt, chief veterinarian and former musher (via Skype)

Each participant held a 15-minute oral presentation, followed by additional questions from the working group. The participants were also asked to sign a declaration of interest. The meeting was in Norwegian (questions are translated to English below). During the meeting, VKM summarised the answers/input from the hearing experts in a document. VKM sent the document to the participants after the meeting to address the additional questions and for final approval. Charlotte Leschbrandt provided a written response to questions by e-mail. The approved summaries (questions highlighted in bold) are presented here:

Answers from Thomas Wærner

1. **Kriterier som ligger til grunn for å ta ut hunder før eller underveis i et løp - hvilke kriterier brukes i praksis, og hvilke kan/burde brukes etter ditt syn?**

   Criteria for removing dogs before or during a race – which criteria are used in practice, and which ones can/should be used, in your opinion?

Dehydrering, vekttap, utmattelse, nedsatt allmenntilstand, samt pneumoni, er viktige uttakskriterier.

Jeg mener at dehydrering, vekttap og grad av utmattelse best kan vurderes av hundekjører, det er kjøreren som ser hundene mest og kjenner dem best. Det er også viktig at løpsledelse og veterinærer følger godt med der kjøreren ikke tar sitt ansvar.

Veterinærkorpset skal avdekke det kjører ikke ser, som pneumoni og nedsatt allmenntilstand. Ulike definisjoner på halthet kan skape problemer mellom veterinær og kjører. I mange tilfeller er hunden støl, ikke nødvendigvis halt og dette går seg til etter oppvarming. Dette gjør kjører ved å tilpasse fart på vei ut ifra sjekkpunkt. Jeg understreker at pneumoni bør vurderes av veterinær, ikke kjører, da hundene kan ha dette uten at det gir seg utslag i redusert appetitt og vekttap.

Jeg er opptatt av at løpsledelse tar ansvar. Det bør være en uhildet dommer som tar endelig avgjørelse om uttak fra løpet.

2. **Hvile, temperaturregulering, dehydrering og vekttap under løp**

   Resting, temperature regulation, dehydration and weight loss during a race

Hvile bør tilpasses spannet. Dette gjelder også farten man kjører med. Det er kjørerens ansvar å vurdere og å gjøre de nødvendige tilpasningene, da veterinærer eller Mattilsynet kun er på sjekkpunkt. Det er viktig å kjøre på hundenes premisser. Jeg vil påpeke at gjerne uerfarne hundekjørere ikke alltid hviler når hundene trenger det.

Jeg mener at siste obligatorisk hvileperiode er særdeles viktig, da dette muliggjør en grundig og seriøs veterinærsjekk. Åtte timers hviletid er kanskje mer enn nødvendig i siste obligatorisk hvile på sjekkpunkt.

«Parkering» (uttrykk i trekkhundmiljøet for at hunden vil ikke gå mer) er et tillitsbrudd mellom hund og kjører. Hundene er da pushet for langt.

Strekket før første obligatoriske hvile kan i mine øyne være for langt i enkelte løp, for eksempel i Finnmarksløpet, der første etappe tar rundt åtte timer. Jeg mener det er viktig at hundene «går seg til i et løp», og derfor ikke går så langt de første etappene. Mange hunder er stresset før start, og det er derfor viktig å begrense den fysiske samt psykiske

påkjenningen i startfasen. Det er her man ser den største forskjellen på erfarne spann og uerfarne. Hunder som er godt trent setter en riktig fart etter forholdene.

3. **Plager/skader i bevegelsesapparatet**

Discomfort/injuries in the locomotor apparatus

En skadd hund har ingen ting i et løp å gjøre.

Det er viktig å sjekke hundens halthet når de kommer inn til et sjekkpunkt, og også når de går ut, men det er gjerne ved innkjøring at halthet vises tydeligst.

En hund som er halt på vei inn til et sjekkpunkt, skal tas ut av løpet. Dersom veterinæren mener hunden er halt, og det er uenighet mellom kjører og veterinær (altså ingen åpenbar halthet), skal hunden kunne gå videre i løpet, men den må vurderes på nytt ved neste sjekkpunkt.

Det er meget viktig at veterinærer har kompetanse på skader og sportsskader, vi opplever meget varierende kunnskap. Løpene må gis støtte fra offentlige organer for å gi muligheten til å bygge opp kompetanse blant veterinærene på løpene. Det er løpene som er Mattilsynet sitt lokomotiv for god dyrevelferd, det er de som setter de etiske retningslinjer sammen med kjørerne på hva som er god dyrevelferd. Dette skal være et godt samarbeid løpene, kjørere og veterinærer om dette.

4. **Mage-/tarmproblematikk**

Gastrointestinal problems

Mage-problemer hos hund vil utvikle seg fort til et problem ved at hunden får hurtig vekttap og blir dehydrert. Hunden trenger da hvile, dette gjøres ofte ved å la hunden hvile i sleden. Ofte gjelder mange hunder i spannet og da må kjører ta ansvar å hvile. Stress har ofte mye med diare. Det er meget viktig at kjører får kjøre sitt eget løp, slik at man kan tilpasse hvile. Ved får mye obligatorisk hvile blir man tvunget til å hvile på sjekkpunkt og ikke på sporet hvis spannet trenger det.

Magesår er vanskelig å oppdage, her er det viktig at kjørere og veterinærer samarbeider godt. Kjører må hele tiden se etter tegn fra hundene som avviker fra det normale. Jeg har både brukt medisiner forebyggende og har kjørt mange løp uten, har ikke hatt problemer med det, men som sagt vanskelig å oppdage.

5. **Medisinbruk**

Medical treatment

Jeg er av den oppfatning at dopingregelverket ikke er tilpasset sporten og det ikke er til hundens beste. Selv sårsalve er ikke tillatt brukt i løp. Jeg ønsker at vi bruker regelverket til Iditarod som er mer tilpasset det vi driver med.

6. Oppstalling gjennom sesongen

Housing of dogs throughout the season

Hundegårder skaper stress og mer lukt, mer dominans og mer bjeffing. Hundene er urolige og løper mye fram og tilbake. Hundene har mer verdighet og stolthet når de har hver sin plass.

Røkteren trenger mer tid å sjekke hundene om de er i hundegård. Når de er på kjetting det er lettere og gå gjennom, stelle og hilse på hunder.

Ved bruk av tette hundehus må isolasjonsgrad tilpasses kulde. Det er viktig at det er tørt der hundene står. De bør ha et visst antall kvadratmetere til å løpe løs på. Eks stolpe med minimum 160 kjetting på en svivel. Dette er da får hunder som er under trening eller er løs flere ganger i uken på sommeren. Det skal være tilgang på friskt vann døgnet rundt, når det begynner å fryse må kjører sørge for at dette kommer i foring.

7. Trening til løp

Training prior to race

Det er viktig at hundene er fysisk og mentalt forberedt til løp og at de hviler (ikke trenes) i perioden mai – juli, men slippes løs og luftes hvis det ikke er for varmt for det.

Hunder som skal gjennomføre slike løp må være forberedt på hva de skal gjøre, jeg mener det er meget dårlig gjort mot hundene å stille opp i løp med dårlige forberedelser.

Organisert trening bør begynnes i august og trappes opp i løpet av høsten, hvordan du skal trene et spann er helt avhengig av spannet du har nå, er det gammelt og erfarent eller er det ungt, et ungt spann må gis et bilde av hva de skal ut på i treningen, men et erfarent spann kan ha vesentlig mindre trening.

8. Skader og dødsfall i forbindelse med løp, inkl. synspunkter på forebygging

Injuries and deaths associated with race, including your opinion on preventive measures

En skadd hund har ingen ting i et løp å gjøre. Dødsfall under løpet er kjører sitt ansvar, og vedkommende bør trekke seg.

Jeg understreker hundekjørers ansvar for vurdering av hviletid, hastighet. Det er viktig at hundekjørerne lar hundenes velferd kommer før ambisjonene.

Det bør være etiske regler for kjørere som løpet står for; noen bør vurdere hvem som skal få kjøre. En slik kvalifisering kan man for eksempel se for seg for de lengste løpene, mens rekrutter kan få delta på de korteste uten denne vurderingen.

Uerfarne som leier seg et spann er ikke ideelt, men det er vanskelig å ha kontroll på. Det er viktig at løpene har rutiner for alle som er uerfarne.

Jeg mener det ville være optimalt med en veterinærsjekk litt før midtveis i løpet ved 16 timers hvile, og så på siste post før målgang ved 4 timers hvile.

Det er viktig med god balanse mellom hvile og fôring/vanning.

Løpene skal sette en standard for hundekjøring, ved å stille krav til kjører. Jeg nevner at treningsmengde for deltakelse i Iditarod må dokumenteres og at hundene som starter her må være vurdert som egnet.

Oppfølgingsspørsmål

Additional questions:

a. **Hvor langt er et kort løp, som ikke krever kvalifisering?**

   How far is a short race that does not require qualification?

   Svar: Et langt løp er noe som går over flere dager. Alt over et døgn bør ha en kvalifisering. Eks start på lørdag, målgang søndag er et løp som er under ganske god kontroll. Dette er løp som både hunder og kjørere skal lære av.

b. **Vil du ha tre veterinærkontroller? En prerace, en ved 16 timer og en ved siste stopp før målgang? Eller flere?**

   Would you prefer three veterinary controls? One at pre-race, one at the 16 hours check point, and one at the final check point before finishing the race? Or more controls?

   Svar: Jeg ønsker en prerace sjekk slik som Iditarod har. Ved hoved hvil og en på siste sjekkpunkt, har ikke kjører kjørt på hundene sine premisser skal person ikke få fullføre. Det må også være anledning for veterinærer å ta en utvidet sjekk hvis de mener det trengs. Dette må da være avklart med løpsleder.

c. **Du svarte ikke på spørsmålet om mage tarm problematikken, og jeg tror heller ikke vi var inne på det under møtet. Er det fordi diaré, og muligens også magesår, ikke oppleves som problemer hos dine hunder? Hvis ja, hva tror du er årsaken? Hva gjør du for å unngå det?**

You did not answer the question regarding gastrointestinal problems, and I believe this topic was not raised during the meeting. Is it because that diarrhoea, and possibly gastric ulcers, is not considered a problem among your dogs? If yes, what may be causing this, in your opinion? What measures do you take to prevent this from occurring?

Svar: Stress er en stor faktor og hygiene for hundene. Se besvarelse i tekst.

Magesår er meget vanskelig å oppdage, man må se etter tegn oss hunden som viker fra det normale. Har man mistanke må veterinærer kjapt inn for å ta en vurdering av allmenntilstand

d. Hva mener du er optimal fordeling av hviletid i langdistanseløp? Hvordan kan dette reguleres bedre enn i dag?

What is the optimal distribution of resting times in a long-distance race, in your opinion? How could these regulations, with regards to resting times, be improved?

Svar: Det er ikke noe som heter optimal generell hvile. Ofte er det kjøreren som er det svake leddet i spannet pga søvn mangel. Man må hvile det som trengs for holde spannet fysisk og psykisk oppe. Det er kunsten av å være en god kjører. Ved obligatorisk hvile blir det kjørt mot den og ikke hvilt etter hvordan spannet trenger hvile. Et sjekkpunkt for hundene er mat og halm. Dette kan man gi dem på sportet. Dette kan ikke reguleres på en måte som passer inn. Ved for mye hvile går farten opp, da kommer det fort skader og hunder som går for hardt, som igjen gjør at de ikke spiser nok.

e. Hvor ofte utenfor løps og treningssesongen mener du at en trekkhund som står i en 12 kvm hundegård eller med kjetting bør gås tur med/løpe fritt?

In your view, how often should a sled dog be walked/allowed to run freely, if housed in a pen with a space of 12 m^2 or tethered, during race- and training season?

Svar: Fra mai til ut juli er det ofte varmt, jeg tør ikke å trene hvis det er over 15 grader, hundene er litt for glad i å løpe og det er stor fare for overopphetning. Jeg mener da man bør slippe de løs i hundegården, noen ganger i uken.

f. Hva mener du er den viktigste velferdsutfordringen for trekkhunder under henholdsvis oppstalling og langdistanseløp?

What is the most important welfare challenge for sled dogs with regards to outdoor housing and long-distance racing, in your opinion?

Svar: Kjørere som ikke kjører på hundene sine premisser er det som er den største utfordringen. Det er meget viktig at løpene har strenge etiske regler som kjørene må leve opp til. Løpene setter også premisser på vaksinering og andre ting som gjør at velferden under oppstalling blir enda bedre.
Jeg er egentlig ikke så bekymret for de som kjører løp, de jobber hardt for å gi hundene det de trenger for å være forberedt til løpene. Jeg er mer bekymret for alle de hunden som folk har som ikke blir brukt og som bare står i en hundegård uten mål og mening. Dette gjelder også andre hunder fra forskjellige miljøer.
Løpene bidrar til at etiske regler for hundehold i miljøet er satt i fokus. Hvis man ser hva løpene i Alaska har gjort for å øke kvaliteten på hundeholdet, ser man at løpene har en meget viktig rolle også for de som kjører tur og ikke er med i noe miljø. Folk strekker seg lenger når de ser at de som kjører fort har høye etiske linjer de følger.

Answers from Petter Jahnsen

1. **Kriterier som ligger til grunn for å ta ut hunder før eller underveis i et løp - hvilke kriterier brukes i praksis, og hvilke kan/burde brukes etter ditt syn?**

   Criteria for removing dogs before or during a race – which criteria are used in practice, and which ones can/should be used, in your opinion?

Body Condition Score (BCS), puls, temperatur, dehydrering, unormale hjertelyder, halthet er kriterier som benyttes i praksis.

Ved ulike løp benyttes ikke samme skala for vurdering av BCS og det er, etter min mening, årsak til at veterinærene bedømmer forskjellig.

Jeg mener at man ikke nødvendigvis må ta ut en hund bare fordi den halter når den kommer inn til sjekkpunkt, men heller basere seg på vurdering av hvordan den beveger seg etter hvile. Jeg anbefaler opprustning av mønstringsområder. Kanskje kan man bruke tråkkemaskiner på et område der hundene kan mønstres. Enkelte hunder er stive, og trenger en liten oppvarming før en kan vurdere om de er stive eller halte.

Jeg mener at vetsjekken er godt organisert men veldig overdrevet og fokusert på en del uviktige ting. Jeg mener sjekken bør begrense seg til noen få parametere.

2. **Hvile, temperaturregulering, dehydrering og vekttap under løp**

   Resting, temperature regulation, dehydration and weight loss during a race

Hundene bør skjermes for støy når de hviler. Inn og utkjøring på sjekkpunkt må ikke forstyrre hundene. Pauser og hvile på sporet bør etter mitt syn brukes mer. Da blir det også mindre smittepress. Tynnpelsa hunder må (dette er kun min mening/erfaring. Ikke faglig begrunnet.) bruke dekken hele tiden i kalde perioder. Vind er et større problem enn kulde.

Blir det for varmt bør man bare kjøre om natta (all obligatorisk hvile er med på å redusere mulighetene kjørerne har for å gjøre kvalifiserte vurderinger om når hundene bør hvile.). Hunder med dårlig appetitt drikker også lite og en får fort vekttap. Det må trenes på å spise og drikke under løp. Parasittbehandling er viktig.

Bruk av teppe på standplass er (kan være, dersom det ikke er for varmt) viktig. Ved å dekke hodet for at det skal bli mørkt og stille, får hundene hvile (dette er ikke en faktor for rutinerte hunder). Det bør være ny og ren halm til alle på standplass.

Vekttap kan ha flere årsaker, som redusert appetitt på grunn av uvante omgivelser/stress, infeksjon med Giardia, og muligens dårligere fordøyelse hos unge hunder. Jeg har en teori om at alt fokus på parasittbehandling ved grensepassering i form av Droncit, har ført til mindre bruk av Panacur (preparater som inneholder virkestoffer mot Giardia. Eks fembendazol) (økonomiske årsaker), og at dette kan være en mulig medvirkende faktor til oppblomstring av Giardia.

3. Plager/skader i bevegelsesapparatet

Discomfort/injuries in the locomotor apparatus

Håndledd og skulderskader er mest vanlig. Massasje er viktig. Noen veterinærer er flinke til å vurdere, men andre stiller med lite erfaring med et mål om å lære. Halthet må vurderes ved innkjøring til sjekkpunktet OG rett etter (adekvat oppvarming etter hvile) hvile.

Ved ømhet i håndledd tidlig i løp, kan dette ofte bli bedre bare ved massasje, mens halthet/smerte mot slutten av et løp oftere er et resultat av et traume. Egen erfaring er at jeg i minst 90% av tilfellene tar hunder ut av løpet selv om veterinær mener de kan gå videre. Jeg har heller aldri vært uenig i vet sin bedømmelse når en hund må tas ut. Dette har jeg en oppfatning av at er gjeldene blant nesten alle kjørere.

4. Mage-/tarmproblematikk

Gastrointestinal problems

God hygiene under løpet er viktig. Det må være rene hvileplasser på sjekkpunktene og ikke brukt halm.

Jeg fôrer med mye suppe, for på den måten også få i hundene væske og unngå dehydrering. ~~Jeg er av den mening at mye sponsor fôr er av dårlig kvalitet, og at det kan være årsaken til at mange får magetrøbbel.~~ Dette var bare en digresjon på spørsmål om hvorfor jeg ikke ville være sponset. Overhode ikke faglig belegg for å påstå dette.

5. Medisinbruk

Medical treatment

Canicur og Zolac og probiotiske midler brukes. Giardia må forebygges. Vaksinering og parasittbehandling er viktig.

6. Oppstalling gjennom sesongen

Housing of dogs throughout the season

Oppstalling må være tilpasset type hund. Isolerte hundehus anbefales basert på hundens preferanse (egen erfaring) og mindre fôr behøves med isolert hus. Åpningen kan dekkes til. Min erfaring er at det er best at hundene står i kjetting. Dette gjelder særlig hunder som står lavt i hierarkiet. Hundene må allikevel slippes løs ofte, og da med full tilsyn. Mine hunder går løse før og etter trening. Jeg er alltid ute sammen med løse hunder for og unngå uønskede hendelser som f.eks slåssing. Hundene må ha tilsyn store deler av dagen, og særlig når de er løse. Mitt poeng her var at det i dag finnes kenneler anlagt på steder uten tilsyn. F.eks i et grustak et stykke unna bebyggelse. Dette er etter mitt syn uforsvarlig med tanke på at disse hundene som regel har tilsyn kanskje bare 1 til 2 ganger daglig.

Tilgang på friskt vann, god hygiene og rengjøring er viktig. Toppdekke skiftes hvert femte år, og det bør være god drenering. Hundegården må ha sollys og være luftig. Møkk bør deponeres annet sted. Igjen, dette er slik jeg gjør det / min mening.

7. Trening til løp

Training prior to race

Kvaliteten på foret må være høy under trening. Det er viktig med tilstrekkelig hvile mellom øktene, men man kan gjerne ha flere økter i løpet av en dag. Intensiteten av treningen må økes gradvis. Det må trenes på det som hunden utsettes for under løp. Kunnskap om trening vs hvile osv.

8. Skader og dødsfall i forbindelse med løp, inkl. synspunkter på forebygging

Injuries and deaths associated with race, including your opinion on preventive measures

Bedre og mer oppkjørte løyper forebygger skader. Løse løyper med mye løs snø er ikke bra. Mye kjøring i tettsteder gjør hundene stresset (poenget her var at inn og utkjøring til disse tettstedene medfører ofte veldig uheldige trasevalg som ofte kan være årsak til skader hos hundene.). Høye pengepremier og økt mediefokus kan føre til mere skader da hundene presses mer enn forsvarlig. Det er høyre risiko for skader i by (svinger, kvalitet av snø, støy, større trafikk), og hos kjørere med høye ambisjoner.

ES: Gode og fornuftige traseer for hundene ikke for publikum. Velge gode traseer spes. de første 30 milene.

Jeg ser på det som negativt at hunder blir lånt ut /lånt like før løp. Det er viktig at kjører kjenner hundene han har foran seg, og raskt kan reagere på små avvik i hundens adferd. Dette er kun mulig hvis en har trent opp hunden til løpet selv. Dette anser jeg som meget viktig!

Kjørerne kan presse hundene for mye i et forsøk på å tilfredsstille sponsor. Dette er ikke noe jeg vet blir gjort, men det er tanker jeg gjør meg. Det synes jeg det er viktig å få med.

Oppfølgingsspørsmål

Additional questions:

a. **Hvor ofte utenfor løps og treningssesongen mener du at en trekkhund som står i en 12 kvm hundegård eller med kjetting bør gås tur med/løpe fritt?**

   In your view, how often should a sled dog be walked/allowed to run freely, if housed in a pen with a space of 12 m² or tethered, during race- and training season?

   Svar: Jeg kan bare fortelle hva jeg/vi gjør og som vi synes er en god løsning.
   Det er kun unntaksvis at hundene ikke løper løs daglig. Også i perioder uten trening.
   Vi har et område på 5 mål inngjerdet.

b. **Hva mener du er den viktigste velferdsutfordringen for trekkhunder under henholdsvis oppstalling og langdistanseløp?**

   What is the most important welfare challenge for sled dogs with regards to outdoor housing and long-distance racing, in your opinion?

   Svar: Vanskelig og trekke frem noe spesielt men jeg forsøker;
   Under oppstalling; mangel på aktivitet

   Under løp; at det lages for rigide regler knyttet til kjøre og hviletidsmønsteret slik at kjørerne ikke får gjort gode kvalifiserte vurderinger om dette selv.

c. **Hva mener du er optimal fordeling av hviletid i langdistanseløp? Hvordan kan dette reguleres bedre enn i dag?**

   What is the optimal distribution of resting times in a long-distance race, in your opinion? How could these regulations, with regards to resting times, be improved?

   Svar: Det er enkelt, **tilstrekkelig!**
   og med det mener jeg at det ikke finnes en fasit. Noen spann er godt trent, noen er mindre godt trent. Det er forskjell på erfarne hunder og uerfarne. Det samme gjelder

erfaringsnivå på kjørerne.

Den obligatoriske hvilen bør reduseres til et minimum. Videre bør man håndheve det regelverket som allerede finnes. Nemlig at det ikke er lov og dra hunder ut av halmen eller et sjekkpunkt. Hundene skal gjøre dette frivillig. Dette blir ikke alltid praktisert i dag, særlig ikke hvis kjøreren er en av de «populære».
Med dagens vet kontroller vil det være enkelt og avgjøre og hundenes velferd er i fare.
Det må selvsagt være muligheter for å gjennomføre slike kontroller, så noe obligatorisk hvile må det jo være.

Dette vil regulere seg selv. På alle lange løp ser man at det hviles mye mere enn det som er obligatorisk. Det er bare det at de obligatoriske pausene gjør at det ikke alltid blir optimal fordeling av denne hvilen.
Vær og føre har mye å si for kjøre og hviletider, men prosentvis er det noenlunde likt uavhengig av forskjellig totaltid.

Eksempelvis på femundløpet 38 – 42 % hvile på teten. På Finnmarksløpet 38 – 45 % hvile i teten.

Answers from Ingrid Wiik Haugbjørg

1. **Kriterier som ligger til grunn for å ta ut hunder før eller underveis i et løp - hvilke kriterier brukes i praksis, og hvilke kan/burde brukes etter ditt syn?**

   Criteria for removing dogs before or during a race – which criteria are used in practice, and which ones can/should be used, in your opinion?

<u>Kriterier som benyttes i praksis:</u>

- En tydelig halt hund.
- Hunden har temperatur over 39,4 eller den har for lav temp., under 37,2.
- Hunden har rød eller brun urin.
- Det er mistanke om smittsom sjukdom.
- Hunden har blodig oppkast
- Hunden har høy puls eller unormale lungelyder.
- Hunden har diaré med blod og allmennpåkjenning som ikke responderer på behandling.
- Hunden har frostskader som ikke kan beskyttes.
- All Sjukdom som krever medisinsk behandling som ikke er godkjent av doping reglementet
- Hunden er avmagret eller dehydrert 8% eller mer (klinisk merkbar dehydrering).

2. **Hvile, temperaturregulering, dehydrering og vekttap under løp**

   Resting, temperature regulation, dehydration and weight loss during a race

Jeg synes hundene fungerer best med jevnlig korte hviler sammenlignet med lange hviler sjelden. Det viktigste med kjøredistanser og hvile er at kjøreren kjenner hundene godt og kjører de etter deres forutsetninger og trening.

Jeg liker best hvile pott slik det er i Pasvik Trail. Der er det 12 timer + tidsutligning som hvilepott til 300km. Det er mye for de beste spannene men det beste spannet vinner likevel.

Jeg liker ikke hviletidene som er «tvungen» for mye i nederste del av det som er mulig på «korte» langdistanse løp som Femundløpet 400km og Finnmarksløpet 550km. Dette fører til at man må presse hundene for å ha vinnersjanse. De kommer da under 40% hviletid. Om hviletiden øker vil det være bedre for hundene (og kjører) men stort sett vil ikke resultatlisten endre seg.

En sledehund som er i god væskebalanse og spiser godt vil regulere temperaturen godt. Men toleranse for kulde er også avhengig av pelskvalitet og beskyttelsesutstyr og måten det brukes på. Fare for frostskader er veldig avhengig av kulde, vind, fartsvind, pelskvalitet, utstyr-dekken, potesokker, vindskydd, mattilgang, væskebalanse. Det går ikke å sette en fornuftig kuldegrense på løp. Grensen er forskjellig fra hund til hund. En Grønlandshund har ikke samme kuldegrense som en Vorstehhund. Alt handler om kunnskap og erfaring hos veterinærteamet, dommere og kjørere; alle må være flinke til å sette grenser for enkelt hunder og spann. Det går fint an å kjøre hunder under temperaturer på minus 40 uten å få frostskader samtidig som noen hunder kan få frostskader under spesielle forhold på så varme forhold som minus 15-20.

Dehydrerte hunder under løp bør ut. Mange hunder fanger vi opp ved at pulsen ikke går ned. Dehydrering disponerer for andre sjukdommer og skader (myoglobinuri, magesår?). Dehydrering kan være et symptom på andre alvorlige sjukdommer. Sirkulasjonssvikt har vært en medvirkende årsak i mange av de dødsfallene som har skjedd. Så selv om dødsfall er veldig sjelden så er dehydrering nesten alltid en medvirkende årsak.

Mange hunder går ned i vekt under løp. Det er ingen grunn til at de må gjøre det! Vekttap kan forebygges gjennom:

* Kvalitetsfôr

* Gode fôringsrutiner

* Kunnskap om forbruk og innhold av kalorier

En hund kan bruke opptil 10-11.000kcal pr døgn- det er veldig mye og mer enn mange kjørere tror når de regner etter antall kg kjøtt og tørrfôr. Hunden må spise ofte, som regel hver 2.time og den må spise forskjellig ved forskjellig temperatur. Hundene trenger ikke være syke eller dårlig form selv om de er litt tynne- individuelle forskjeller. Hvis de er tynne ved start og holder vekten gjennom løpet gjør det ingenting om de er den tynne typen.

3. Plager/skader i bevegelsesapparatet

Discomfort/injuries in the locomotor apparatus

Hundene som går langdistansetrening og løp ligger langt, langt under gjennomsnitts hunden når det gjelder plager og skader fra bevegelses apparatet.

Bevegelse, trening og konkurranser er det beste forbyggende tiltaket en kan gjøre mot skader. Disse hundene kan gå Iditarod når de er både 10, 11, og til og med 12-13 år. En vanlig familiehund ville ikke hatt mulighet i det hele tatt til å løpe 1600km når den er 10år. Bevegelsesapparatet på en langdistansehund er helt utrolig solid noe som kommer av år med god trening og fôring.

Skader i langdistanseløp:

Myoglobinuri. Trekkhunder har en tydelig økt risiko for myoglobinuri i forhold til hunder som ikke brukes til fysisk aktiviteter som trekk, jakt eller gjeting. Dette forebygges ved god trening på det varierende underlag. Viktig å trene godt også siste uka før løp og en bør redusere fettfôringen siste uka før start. God væskebalanse er viktig.

Muskelruptur av gastrocnemicus. Forebygges ved riktig trening og gjenkjenne symptomer.

Bicepssenebetennelse.

Ømme ledd som håndledd og skuldre, men har aldri sett en hund med korsbåndskade på løp. Nesten alle skader hundene blir tatt ut for under løp er helet etter 3 uker sjukemelding.

4. Mage-/tarmproblematikk

Gastrointestinal problems

Mage/tarmproblemer øker ved harde anstrengelser. Nesten alle diareer på løp er fôringsbetinget. Dette forebygges gjennom nøye uttenkte fôringsregimer- kunnskap igjen! Halv fôring dagen før og en bør ikke gi mat på dagen rett før start. Kun vanning 2 timer før start. Snack hver 2. time. En bør ikke blande kjøtt og tørrfôr før fôring. (Premiks av fôr før en drar hjemmefra øker sannsynligheten for matforgiftning).

Ved diare gi tørrfor tørt, og ved oppkast bør en bløte tørrfôret en liten stund før fôring. En må ikke varme maten og la den stå. Ikke tynn ut maten og gi diaréforebyggende tilskudd som melkesyrebakterier og fiber.

Magesår er meget vanskelig å diagnostisere. Det lar seg ikke diagnostisere med rimelig sikkerhet uten gastroskopi eller at de kaster opp blod. Det er også et problem på sprinthunder, mellomdistanse, og jakthunder. Samme frekvens hos langdistansehunder, sprinthunder og amerikanske forsvarshunder som er undersøkt. Ingen undersøkelser jeg har sett på jakthunder eller andre hunder som brukes mye.

5. Medisinbruk

Medical treatment

Dopingregelverk gir retningslinjene. NHF er underlagt Norges Idrettsforbund. Det nye dopingregelverket åpner for store variasjoner fra løp til løp da mye bestemmelser tilfaller sjefsveterinæren.

Jeg ønsker ikke mulighet for bruk av medisiner for å behandle akutte sykdommer under løp. En hund som blir syk synes jeg skal sykemeldes. Jeg ønsker muligheten til å bruke medikamenter som forebyggende behandling mot magesår så lenge vi ikke vet hva som forårsaker det og vi ikke kan stille diagnosen under løpet slik at vi kan ta de utsatte individene ut. De positive sidene ved idretten og alt hundekjørerne kan lære gjennom løp gjør at jeg heller vil forebygge magesår med en tablett om dagen enn å slutte å ha løp.

6. Oppstalling gjennom sesongen

Housing of dogs throughout the season

Hundegårder: Mange hunder sammen i hundegård gir risiko for høyt stress nivå. Enkelte hunder kan bli nektet tilgang til liggeplass av andre hunder med høyere rang.

Slåsskamper og bittskader kan oppstå ved løse hunder sammen og det blir dårligere overvåking av helsen ved flere hunder i hundegård sammen. Ellers kan det etableres av streng rangorden med «hakkekyllinger» og tjuvparringer kan/vil oppstå.

Kulde og varme er en risikofaktor ved dårlig tilpassede hundehus.

Mangel på mosjon er sjelden et problem på hunder utendørs sett i forhold til hunder som bor inne. De vil alltid kunne bevege seg mer enn en hund i bur eller på et lite rom som gangen eller et vaskerom. Kunnskap og god management er viktig! Det er det det alltid handler om, enten hunden bor inne eller ute. Den største risikoen ligger alltid på den som steller!

Når sauer sulter i hjel så er det ikke sauehold i Norge det er noe galt med men det er noe galt med den som skulle fôre (og evt. de som kjenner røkteren og ikke reagerer).

Negative effekter forebygges lettest ved å ha hundene i kjetting og hvert sitt hus med hvert sitt område- helst med syns kontakt med en nabo de liker. Hver hund skal ha sitt hus og område, og hver hund sin mat og vannskål.

Oppstalling enkeltvis forebygger stress og sikrer hvile og riktig mat til alle. I tillegg gis også mulighet til å overvåke matlyst, drikkelyst og avføring. Oppstalling ute gir større bevegelsesmuligheter enn inne.

For å sikre minimum bevegelsesområde bør det gis retningslinjer for antall kvm hunden kan bevege seg på når den er oppstallet. Retningslinjene i dag sier 12kvm ved oppstalling på kjetting. Dette bør også gjelde for hunder i hundegård som nå.

Hus og liggeplass må tilpasses til den enkelte hund/hunderase. Hundene må gis en tørr, trekkfri liggeplass med isolering som passer rasen. Fordelen ved oppstalling ute kontra inne er mindre fukt, mer luft, mer sol. Største problemet kan være at vannet fryser ute og dårlige hundehus/dårlig liggeunderlag for tynnpelsede hunder

Hunder som oppstalles ute og som brukes til konkurranser har lite aggresjon, og de har veldig sjelden (til aldri) ørebetennelser. Eierne har lite problemer med hunder som er engstelige eller har uønsket adferd.

På grunn av antall og at de er mye løse sammen i grupper på 10-20 av gangen så er det økt antall tjuvparringer. Som på katter ville dette kunne forebygges ved å anbefale kastrering. Kastreringsforbudet øker problemet med tjuvparringer og det å kunne ha hele flokken løs sammen. Fôrinntak kan reduseres hos hanhund i kontakt med løpsk tispe.

7. Trening til løp

Training prior to race

Trening til løp starter normalt i begynnelsen av august. Det er viktig å ikke trene når det er for varmt p.g.a faren for overoppheting

Sikkerheten ivaretas best ved å ha:

* God kunnskap

* Gode bremser og godt utstyr

Hunder som trenes til løp blir stort sett tatt mer vare på enn de som kun driver rekreasjon. Konkurransene gjør at kjørerne hele tiden søker viten som skal gjøre dem bedre.

Det er helt vanlig på klinikken min at noen kommer inn med en hund de vil jeg skal sjekke fordi den ikke fungere helt optimalt på trening. Hunden kan godt ha trent 300km i løpet av helgen uten å halte, men eieren mener allikevel at det er noe galt med hunden. Eieren har stort sett alltid rett.

Trekkhunder som går tur og turisthunder blir stort sett ikke tatt vare på samme måte som konkurranse hunder. Ambisjonene til kjøreren er ofte til nytte for hundene i løpet av treningssesongen. Noen ganger kan litt for store ambisjoner skape problemer på løp. Men under treningssesongen er det konkurransene som gjør at treningen blir holdt vedlike, at det beste fôret blir kjøpt og at de trenger alle vaksiner etc. up to date

Det er en risiko for overtrening. Mange langdistanse spann er trent 5.000-6.000km på en sesong. De pleier å løpe løse som oppvarming før de settes i spannet og etter de kommer hjem. Med 10km i snitt fart så blir det 500-600 timer trening fra 1.august til 1.mars. Det blir 78 timer trening pr mnd., 18 timer pr uke+ tid til oppspenning, møkkpelling og fôring. Fôring med for mye fett er en risiko for å få skader pga mangel på proteiner.

8. Skader og dødsfall i forbindelse med løp, inkl. synspunkter på forebygging

Injuries and deaths associated with race, including your opinion on preventive measures

Det er alltid uheldig og trist å ha dødsfall på løp men jeg tror ikke vi kan komme ned på en 0 rate. Hunder dør hjemme, de dør på jakt og de vil kunne dø på løp. Vi må streve for at dødsraten skal være lavest mulig og at de dødsfall som oppstår ikke oppstår på grunn av dårlig stell eller ufornuftig bruk av hunder.

For å sette dødsfall på løp litt i perspektiv så er det akutte dødsfall for folk som går på langrenn – 1/13.000 aktivitetstimer(USA?).

Akutte dødsfall raten for langrenn brukt som estimat for dødsfall under Iditarod ville gitt 5,6 døde hunder pr år. (Samme rate som langrenn pr time hunden løper). Det reelle tallet for dødsfall på Iditarod ligger under 1 pr år (kilde: The sled dog Athlete by Peter D. Constable BVSc, MS, PhD, DipACVIM. Illinois).

På Femundløpet er antall hundetreningstimer på ca. 101.760 aktivitetstimer. Hvis det var langrenn ville vi ha 7-8 dødsfall pr løp. I 2017 døde det ingen hunder under Femundløpet.

Hundene er godt forberedt på det de skal ut på og vi har heldigvis få dødsfall. Det betyr ikke at vi skal forebygge det beste vi kan. Det er også hunder som dør under og etter jaktprøver men det blir ikke fokusert på i pressen. At folk dør mens de jogger (1/396.000 aktivitets timer) eller at de dør når de går langrenn gjør ikke at leger advarer mot å gå på ski. Langt flere dør tidlig av et inaktivt liv.

Oppfølgingsspørsmål

Additional questions:

a) Hva tenker du om det du sa om at foret som vanligvis gis under løp i Norge inneholder for mye fett i forhold til protein? Hva tror du ville bli annerledes under løp hvis fettprosenten ble lavere? Er dette kun et økonomisk spørsmål?

You mentioned earlier that the feed that is commonly given to dogs during racing in Norway contains too much fat in relation to proteins. What are your thoughts on this? What do you think would be different during race if the amount of fat was reduced? Is this solely an economic question?

Svar: Fettprosenten er som regel ikke et problem under et løp men i løpet av en treningssesong vil fettprosent på over 60 % av energibehovet gi mer halte hunder. Dette er vist under fôringsforsøk i Alaska. Noe vi tror kommer av proteinmangel og mangel på reperasjon av musklatur og sener under restitusjon. Det er et spørsmål om tilgjenglighet . De store fabrikkene som produserer og selger hundemat i Norge har et generelt høyt fettinnhold. Noe som kommer av tilgjenglighet på slakteavfall-fett er lett tilgjenglig mens det er mangel på lever og slakteavfall med høyere proteininnhold. De fleste hundekjørere kjøper slakteavfall av de store firmaene og gir litt tørrfôr ved siden av. Ikke mange som klarer å regne seg til om de mangler proteiner. Produsenten sier det er godt nok og det er ikke alltid lett å se at det ikke er det. Fettprosent påover 60% av kaloriene kan også gi anemi og tegn på leverpåkjenning som gir dårlig matlyst og ketose tendenser.

b) Hvor ofte utenfor løps og treningssesongen mener du at en trekkhund som står i en 12 kvm hundegård eller med kjetting bør gås tur med/ løpe fritt?

In your view, how often should a sled dog be walked/allowed to run freely, if housed in a pen with a space of 12 m2 or tethered, during race- and training season?

Svar: Fra 4 x pr uke til daglig. Slik jeg anbefaler for innehunder.

c) Hva mener du er den viktigste velferdsutfordringen for trekkhunder under henholdsvis oppstalling og langdistanseløp?

What is the most important welfare challenge for sled dogs, with regards to outdoor housing and long-distance racing, in your opinion?

Svar: oppstalling- tilsyn er viktigste faktoren som bestemmer om det går bra eller dårlig.

Løp – viktigste velferdsutfordringen er konkurranse instinktet til kjører og hunden selv, og gammeldags oppfatning om at langdistanseløp skal være så tøffe som mulig. Heldigvis er det ikke de med de holdningene som vinner.

d) Hvor ofte ser du frostskader?

How often do you see frostbites?

Svar: Tja ca hver 3.år. Kan være flere år uten kulde som gir frostskader og så kan det være et løp hvert 8-10 år med sterk kulde og flere frostskader samme løp.

a. **Hva mener du er optimal fordeling av hviletid i landistanseløp? Hvordan kan dette reguleres bedre enn i dag?**

What is the optimal distribution of resting times in a long-distance race, in your opinion? How could these regulations, with regards to resting times, be improved?

Svar: vet ikke. Veldig vanskelig å svare på. Stort sett mener jeg det er greit regulert siden vi ikke vet hva det optimale er. Men jeg liker personlig hvilepott.

Answers from Arnt Ola Skjerve

1. **Kriterier som ligger til grunn for å ta ut hunder før eller underveis i et løp - hvilke kriterier brukes i praksis, og hvilke kan/burde brukes etter ditt syn?**

Criteria for removing dogs before or during a race – which criteria are used in practice, and which ones can/should be used, in your opinion?

Det er viktig å ha god kunnskap om hundene allerede før løpet, og vurderinger gjøres fortløpende hjemme i god tid før løpet (treningsgrunnlag, historikk, osv). Hundene skal være 100 % friske før løpet. Body score sjekkes før løpet. Det er rart om hunden må tas ut på prerace sjekk siden sjekk hjemme burde vise hvis hunden ikke egner seg til løpet. Jeg opplever bedre overensstemmelse mellom egen og veterinærens vurdering av hundenes hold etter at de innførte bruk av BCS.

Unormalt vekttap, ømme skuldre og håndledd gjør at hundene tas ut av løpet. Det bør være klare kriterier for uttak under løp. Også eldre hunder tas ut av løpet. Unghunder med ømme håndledd burde tas ut tidligere siden de har liten erfaring og de kan lett bli skadet. Med voksne hunder med ømme håndledd er det er mulig og vente litt og se om plagene bedrer seg (halthet). Ved ømme skuldre tas hundene ut med en gang. Første tegn på lungebetennelse er god nok årsak for å ta hunden ut av løpet.

Veterinærens jobb er å følge med på det som kjører ikke ser; som begynnende pneumoni, høy puls etc. Jeg ønsker ikke innblanding i vurdering av haltheter. Det viktigste hundestellet foregår på sporet og ikke på sjekkpunkt.

2. **Hvile, temperaturregulering, dehydrering og vekttap under løp**

Resting, temperature regulation, dehydration and weight loss during a race

Varme er ofte et større problem enn kulde. Nok vann og riktig fôr er viktig. Det er viktig å sjekke for frostskader. En lang 16 timers sjekk/stopp kan være bra, da hunden i løpet av en slik lang hvileperiode tydeligere kan vise om noe er galt. Det er mulig og hvile på sporet, som er mye bedre for hundene. Det er mulig og ta liggeunderlag med seg og bruke når det ikke er så veldig kaldt. Liggeunderlag kan tas på sleden på et sjekkpunkt og kan leveres på

neste, så det betyr ikke stor belastning for spannet. Dekken må brukes på hunden når de hviler i kaldt vær.

3. **Plager/skader i bevegelsesapparatet**

   Discomfort/injuries in the locomotor apparatus

Det er mest ømme muskler. Det brukes sjelden medisiner. Nok hvile hjelper.

4. **Mage /tarmproblematikk**

   Gastrointestinal problems

Anstrengelsesdiare må påregnes, og der er vanlig midt i løpet.

5. **Medisinbruk**

   Medical treatment

Canicur gis forebyggende mot diare. Jeg har lite erfaring med medisinbruk ellers, men jeg har en formening om at noen hunder spiser dårligere etter bruk av protonpumpehemmer (magesårsmedisiner).

6. **Oppstalling gjennom sesongen**

   Housing of dogs throughout the season

Jeg har både hundegårder med 2 og 2 hunder sammen, og hunder på kjetting. Begge deler greit. Enkelte hunder har preferanse for hundegård eller kjetting basert på tidligere erfaring, men alle har mulighet til fri lek løs nesten hver dag. Det er viktig med hundegårder som gir mulighet for løsslipp før og etter trening, på hviledager og på sommeren. Løsslipp reduserer stress og gir mulighet for hundekjøreren til å bli bedre kjent med hundene. Krangling under løsslipp er veldig sjelden. Hundehusene har isolerte gulv mot kulde. Det er mindre slåssing med eget hus, og det er viktig alltid å være tilstede når hundene er løse.

7. **Trening til løp**

   Training prior to race

Hundene er mye i aktivitet uten at det trenger å være spesifikk trening. Det er viktig å vurdere treningsgrunnlaget før løp. Riktig fôring er viktig for god effekt av treninga. Hundene må ofte trenes forskjellig.

8. **Skader og dødsfall i forbindelse med løp, inkl. synspunkter på forebygging**

   Injuries and deaths associated with race, including your opinion on preventive measures

God kunnskap om hundene (med spesielt oppmerksomhet på tidligere skader, fysisk stand, sykdommer) forebygger skader og dødsfall. God oppfølging fra veterinær er viktig. Hundene må være best mulig forberedt til løpet. Hunder som ikke presterer som forventet må tas ut og sjekkes.

Answers from Annette Kriller

1. **Kriterier som ligger til grunn for å ta ut hunder før eller underveis i et løp - hvilke kriterier brukes i praksis, og hvilke kan/burde brukes etter ditt syn?**

   Criteria for removing dogs before or during a race – which criteria are used in practise, and which ones can/should be used, in your opinion?

Brukes:

Too thin dogs
Dehydration
Abnormal lung sounds
Ongoing diarrhea with blood, irresponsive to treatment
Vomiting with blood
Red or brown urines (indication of myopathy)
Irregular heart rhythm or heart rate
Hyperthermia/hypothermia
Frostbite injuries that cannot be prevented from re-freezing
Certain types of lameness

Bør etter mitt syn også brukes:

Drivers with inappropriate attitude towards their dogs.

2. **Hvile, temperaturregulering, dehydrering og vekttap under løp**

   Resting, temperature regulation, dehydration and weight loss during a race

Rest:

Races are nowadays run mostly by increasing the runtime and decreasing rest. Speed is almost secondary. The longer the race, the less important is speed.

My concern is that this leads to severe sleep deprivation of the dogs (and mushers). Sleep deprivation in dogs is difficult to verify, other than by attitude. To highlight the importance of enough sleep and dangers of sleep deprivation they send out letters to the mushers prior to the race, to draw attention to benefits of sleep and possible negative outcomes of sleep deprivation. "Parking" is a term used by mushers to describe a state of mind, when dogs just stop and don't go further. Mushers often just sit and wait until dogs rest enough to continue, then mushers continue the race.

In my opinion, "parked" dogs should not be allowed to continue in the race. The dog is indicating that enough is enough, and should be allowed to discontinue the race.

Temperaturregulering:

Hypothermia is generally not an issue in races (or kennels).

Nordic breeds are generally very capable to regulate body temp. It is, however, important that the dogs are adapted to the cold. Too well insulated houses, for instance, may compromise temperature regulation under cold conditions.

Alaska Husky has a good undercoat even if their coat seems thin.

Dogs should always be protected against wind. Straw and blankets are commonly used. When possible, dogs should rest in groups. Short coated breeds need more protection.

Hyperthermia is a more relevant concern in these dogs. It is important to keep in mind that sun, dark coats and booties contribute to this condition, but this problem is more of high risk in Southern Europe.

Dehydrering:

Dehydration is an important topic, of which mushers are generally aware. The condition is easy to identify for both vets and mushers. It is good in Norway, that checkpoints are relatively close to each other (contrary to e.g. Yukon Quest) and so dogs are checked relatively often for dehydration. Dehydrated dogs will have to stay at checkpoints. In my opinion, more emphasis needs to be put on preventing dehydration. This may be done by training the dogs to drink water, and by letting them be used to a combination of drinking and snacking.

Vekttap:

Weight loss is a big problem in long distance sled dog racing. There are several contributing factors. Mushers might have too little knowledge about feeding dogs, resulting in improper feeding technique, timing and/or quality of the food (quality of food may be an economical issue). The psychological state of the musher is also of importance. Weight loss might easily be overlooked by mushers, or even intentionally covered up (or may even think that fat dogs don't run that fast). Contributing factors in the dogs might be too low body weight at the start and stress induced anorexia.

The musher may sometimes give too little food because they know that the food might be of poor quality and then may cause diarrhea.

Important with regular feeding. Dogs will not always eat at checkpoint.

3. Plager/skader i bevegelsesapparatet

Discomfort/injuries in the locomotor apparatus

Parts of the locomotor system especially prone to injuries in these dogs are feet, carpal joints, shoulders, back and hocks. Tendons in general, as well as the particular muscles M. gastrocnemius, M. pectinaeus and M. semimembranosus, are under high strain and thereby at high risk of injury.

Approximately 60 -70 % of injuries need to be treated by vets. Some injuries are treatable by massage and/or rest during the race (depending on the duration of the race). Others might be reasons to drop. If detected early enough most will heal with rest. Very few injuries require surgery, and very few dogs sustain permanent injury keeping them from running.

Important measures to prevent injuries are adequate training, adequate rest and feeding, proper driving and knowledge and experience of musher.

4. Mage/tarmproblematikk

Gastrointestinal problems

Diarrhea:

Stress induced diarrhea is very common. Also, Giardia, Clostridium and Salmonella are causative agents of diarrhea in sled dogs. However, diarrhea induced by virus is rarely seen.

Some prevention might be achieved through proper training/preparation for races (reduction of stress). Proper feed quality, vaccination, deworming and hygiene management are important measures to reduce the incidents of diarrhea.

Gastric ulcers:

Gastric ulcers are induced by stress related to training, travelling, crowding, start, racing and extraneous exercise. Adequate training/preparation, a healthy immune system, as well as quality dog food and medication help prevent gastric ulcers.

5. Medisinbruk

Medical treatment

IFSS rules apply. Medical prevention of gastric ulcers is non negotiable, until research reveals other solutions. Topical treatment of conditions of the locomotor system (treatment includes massage) and eyes is preferred to systemic treatment. Medical diarrhea management (even by Metronidazole) is recommended. Use of antibiotics is recommended when regarded as necessary by race vets.

Alternatives to using drugs would be no (long distance) racing at all or dropping dogs early. The latter, in turn, would increase the stress on remaining dogs. Therefore, the minimal limit

of number of dogs would need to be increased, which again could lead to conflict between mushers and vets/officials.

6. Oppstalling gjennom sesongen

Housing of dogs throughout the season

Pro tethering:

Closer contact with individual dogs
Better control with feaces, vomit and urine – hygiene
Stress free environment for eating, sleeping and resting
Increased "group" feeling
Easy to add new dogs
No dog fights

Contra tethering:

Monotonous circle, development of stereotypical behaviour
One-sided circular motion
Boredom
No interaction with other dogs, diminished social competence

Pro kenneling:

More space
Free movement, balanced and symmetrical movement
Interaction with other dogs
Choice of spaces
Social competence

Contra kenneling:

More aggression through fencing
Interaction of musher with individual dogs more difficult
Feeding takes more time and effort
Less control over faeces or vomit
Higher risk of dog fights
Development of small individual groups

Conclusion: Individual management is the determining factor. Neither tethering nor kenneling is good if not managed right.

My suggestions: Dogs should have time and space to run free and be together as a big group – ideally most of the time. Introduction of newcomers should be performed slowly and

carefully. Tethering of dogs should be restricted to feeding and/or at night. Dogs in training should be given more individual space. Management of bitches in heat is of importance.

7. **Trening til løp**

Training prior to race

It is important that training is adjusted accordingly to the type of race. The age of the dogs needs to be considered. In the racing situation, it is important to focus on the welfare of the dogs and to keep in accordance with the intensity and mode of the preceding training.

8. **Skader og dødsfall i forbindelse med løp, inkl. synspunkter på forebygging**

Injuries and deaths associated with race, including your opinion on preventive measures

My opinion: Educating mushers and implementing knowledge is crucial to prevent injuries and deaths. Focus should be on raising ethical standards and on seeing each dog as an individual. This is difficult to regulate by rules only. Increasing public awareness is key.

What about increasing rest time, as was mentioned during the presentation?

Answers from Charlotte Leschbrandt

Veterinærens rolle:

HOVEDVETERINÆR

Løp som går over en viss lengde bør ha en hovedveterinær som møter og har stemmerett i løpets sportslige styre. Alle avgjørelser som er av betydning for hundene i løpet, bør involvere hovedveterinæren.

JOURNALFØRING UNDERVEIS

Tunge krav til journalføring og dokumentasjon går utover muligheten til å gjøre en god jobb. Det bør tas hensyn til de forholdene som er rådene på sjekkpunktene, med snø, vind, muligens regn, og en til tider ekstrem arbeidsmengde. Det bør ikke være sånn at krav til journalføring kommer i veien for tid til en best mulig undersøkelse av hundene.

Hundene bør gjennomgå en rask undersøkelse av veterinær med relevant erfaring eller kursing på fortrinnsvis hvert sjekkpunkt (på et løp som Finnmarksløpet), eller tilsvarende ca hver 15. mil. Dette bør gjennomføres etter beste evne uten noen videre krav til obligatorisk kontroll og utfyllende journalføring. Det er ikke tilstrekkelig at hundene undersøkes grundig på ett eller to sjekkpunkt på et langt løp som for eksempel Finnmarksløpet, da skader og sykdom kan oppstå raskt.

Journal må være i bruk, som et verktøy for kommunikasjon og felles hukommelse blant veterinærene som jobber på løpet, men det burde være av mindre betydning om dette er pent skrevet og lett å forstå for tilsyn i ettertid.

ANTALL VETERINÆRER

Istedenfor journalkrav bør det være krav til et minimum antall veterinærer basert på antall hunder i løpet, og antall sjekkpunkt de fordeler seg på. Dette er den beste måten å sikre tilstrekkelig veterinærtilsyn med hundene.

UNDERSØKELSE AV HUNDENE

Ved undersøkelse av hunder på sjekkpunkt bør puls bør være hovedparameteren. Erfaring tilsier at det er lite sannsynlig at en kompromittert hund vil ha lav hvilepuls på sjekkpunkt. 120 må ikke nødvendigvis være cut off point. Mange hunder blir stresset av at veterinæren nærmer seg, og pulsen stiger fort til 120. Det kan være lurt å vente med pulstaking til man har brukt noen sekunder på å bli litt «kjent» med hunden. Pulsfrekvens på 130-140 bør derimot avstedkomme undesøkelse som til slutt avdekker en årsak, eventuelt diskvalifisering på mistanke om en uoppdaget lidelse. Undersøkelsen bør foregå raskt slik at dette ikke går utover hundenes hviletid og bør skje forholdsvis raskt etter innkomst til sjekkpunkt. Dersom man ikke rekker å undersøke spannet før kjøreren er ferdig med stell og foring bør spannet undersøkes idet de er i ferd med å sale opp for utgang fra sjekkpunkt, slik at hundenes mulighet til en lang sammenhengende hvile blir ivaretatt.

Utover undersøkelse av puls mener jeg at det viktigste er å observere spannene især idet de løper inn men også idet de løper ut av sjekkpunkt. En hund med haltfritt ganglag inn til sjekkpunkt, som virker våken og oppmerksom og som har hvilepuls innenfor normalområde, er ved stor sannsynlighet innenfor sin komfortsone.

ANSVARSFORHOLD

Hundekjøreren bør alltid være ansvarlig for ivaretagelse av sine hunder. Rent formelt bør dette ansvaret ikke på noen måte fordeles mellom veterinær og kjører. Dette for å bevisstgjøre kjøreren ansvaret, men også fordi det fulle kliniske bildet er helt avhengig av at hundekjøreren og veterinæren samarbeider og deler informasjon. Det bør dermed gå helt tydelig fram at det ikke er veterinæren, men hundekjøreren selv som råder over hvilke hunder som eventuelt skal settes igjen på sjekkpunkt. Det bør likevel være slik at veterinæren kan overstyre en kjørers avgjørelse, slik at veterinæren kan diskvalifisere hunder fra løpet.

MEDISINBRUK

Jeg er skeptisk til obligatorisk medisinering på løp (for eksempel magesårmedisinering). Dersom forholdene rundt løpet er for stressende for hundene, bør løpet justeres, og ikke hundene. Jeg syns det er problematisk å sette hundene i en situasjon hvor det er nødvendig med medikamentell behandling for å forebygge sykdom. Aktuell forebyggende medisinering

mot utvikling av magesår er mest sannsynlig heller ikke testet ut på hunder under gjeldende forhold på langdistanseløp, med tanke på muligheter for andre virkninger (og bivirkninger) enn den tilsiktede forebyggende effekten på utviklingen av magesår.

Langdistanse sledehundløp er en svært fysisk krevende for hundene. Derfor bør man så langt som mulig forsikre seg om at aktiviteten befinner seg innenfor hundenes tålegrense. Det er vanskelig å være sikker på at løpsforholdene er innenfor tålegrensen hvis man må ty til medikamentell behandling for at de skal tåle belastningen.

I Norge (og Sverige) har vi en lang tradisjon for å avvikle løp uten noen form for medisinbruk på hunder som fortsatt er med i løpet. Dette i motsetning til for eksempel amerikanske løp., hvor det for eksempel er vanlig å bruke metronidazol mot ulike former for diaré underveis i løpet. For meg synes dette som et felt hvor det er behov for flere studier av mulige utilsiktede virkinger.

En hund som er påkjent på en eller annen måte slik at det er nødvendig med medikamentell behandling, bør ikke samtidig utsettes for den ekstreme belastningen et langdistanse sledehundløp representerer. Den bør tas ut av løpet, og deretter behandles.

HVILETID

Det er viktig at hundene får nok tid til å hvile og restituere, og dessuten nok ro og overskudd til at de tar til seg nok mat og væske på og/eller i mellom sjekkpunktene. Det kan i noen tilfeller virke nødvendig å stimulere til at kjørere legger inn mer hviletid.

Dersom det skal legges inn obligatoriske hviler, bør det legges inn NOK hvile. Obligatorisk hviletid gjør at hundekjørerne hviler mindre på de sjekkpunktene hvor det ikke tas ut obligatorisk hvile, og noen gambler nok på at hundene holder koken til der hvor dette skal tas ut. Det er ikke usannsynlig at regler om obligatorisk hvile, dersom dette likevel ikke er tilstrekkelig hviletid, dermed fører til mindre total hviletid enn dersom hele hviletidsdisponeringen hadde vært opp til den enkelte hundekjører.

Dersom det skal avholdes en begrenset mengde obligatorisk hvile kunne det være fornuftig å legge disse hvilepausene til for eksempel første tredel av løpet. Det ville på denne måten være vanskelig å kjøre resten av løpet uten hviletid, og forslaget kan kanskje avstedkomme at den totale hviletiden går opp i forhold til hvordan løpene kjøres nå. På mange måter kan det virke fornuftig å hvile mest tidlig i løpet. De første timene og dagene skal hundenes kroppssystemer tilpasse seg den ekstreme belastningen, og det er i begynnelsen grunnlaget for flere av de senere skadene legges. Dette mønsteret bekreftes også i fordypningsoppgaven til Hanne Marthe Kuthi Andreaasen «Anstrengelsesutløst rhabdomyolyse hos langdistanse sledehunder», Oslo 2010. Her framgår at om lag en tredel av hundene hun undersøkte hadde tegn på klinisk eller subklinisk myopati allerede på de første to sjekkpunktene. Man antar at denne forekomsten flater ut videre utover i løpet.

Det er vanlig å legge inn obligatorisk hvile på siste sjekkpunkt med det formål at hundene skal se bedre ut for publikum når de krysser mållinjen. Denne praksisen bør det bli slutt på. Hundene trenger denne hvilen underveis i løpet. Hele løpet bør kjøres slik at spannene kan vises fram for publikum.

Et annet alternativ kunne være å legge inn lange gode obligatoriske hvilepauser på hvert sjekkpunkt. En hviletid på omtrent 5 timer på hvert sjekkpunkt (i tilfelle Finnmarksløpet) ville i så fall kunne være tilstrekkelig, og enhver må selvsagt stå fritt til å hvile sitt spann lenger enn dette. Dette vil føre til at etappetidene går ned, og man kan tenke seg at hundene pådrar seg flere skader relatert til høy fart. Økt forekomst av fartsrelaterte skader synes fra et dyreetisk ståsted som et bedre alternativ enn at hundene kjøres fysisk og psykisk ned i sakte fart og med lite hviletid. Det er heller ikke sikkert at fartsrelaterte skader i så fall ville øke. Denne antagelsen baserer seg mest sannsynlig på at tempoet oftest er høyest i starten av de lange løpene, og samtidig opplever man flest av de såkalte fartsrelaterte skadene. Det er imidlertid ikke usannsynlig at disse skadene ville vært forbeholdt løpets begynnelse uavhengig av at farten forblir høy gjennom hele løpet, nettopp fordi som før nevnt at hundenes kroppssystemer i starten av løpet må venne seg til den vedvarende høye aktiviteten.

Videre kan man for å stimulere til mer hviletid øke antall hunder som fortsatt må være med i spannet over målstreken.