

Is Snow a sufficient Source of Water for Horses kept Outdoors in Winter? A Case Report

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Due to extreme weather conditions, a flock of outwintered Icelandic horses had to manage for several days on snow as the source of free water. They were fed grass silage *ad lib*, and any change in feed consumption was not observed. After nine days, blood samples were taken and analysed for plasma osmolality, they were subjected to a simple clinical examination, and offered drinking water. Osmolality levels were within normal limits and mean value did not differ significantly from samples which previously were taken of the same individuals. The general condition of the horses was normal, with no signs of clinical dehydration or disease. The horses showed very little interest for the offered drinking water. This suggests that in cold winter weather, horses being fed grass silage and adjusted to eat snow, can manage for several days with snow substituting liquid water without their physiology and welfare being challenged.

Water source, snow, horse, thirst, osmolality, welfare.

Introduction

The need for water is a basic motivating force for animals. Thus, one of the five freedoms in evaluating animal welfare is the freedom from thirst, hunger and malnutrition (*Brambell committee* 1965). Further, the need for adequate water supply is emphasised in animal welfare regulations, like the Norwegian Animal Protection Act.

Water is lost from the body by urine and faeces, evaporation from the respiratory tract and skin, sweat, and in the lactating mare, milk. These losses must be compensated, and the body has three sources for water; drinking water, water content in the feed, and metabolic water, i.e. water generated by the biochemical processing of digested nutrients. A rise in the osmotic pressure of the extracellular fluid stimulates osmoreceptors in hypothalamus, which in turn elicits the excretion of vasopressin (anti di-

uretic hormone), and a three percent increase in osmolality also gives a subjective feeling of thirst in most mammals (*Sjaastad et al.* 2003). Water demand in horses depends on factors like physiological state (e.g. lactation), air temperature, exercise, and diet, and water consumption also varies with habits, watering method, and water temperature (*Hinton* 1978, *Crowell-Davis et al.* 1985, *Cymbaluk* 1990, *Kristula & Donnell* 1994, *Scheibe et al.* 1998, *Nyman et al.* 2002). Many wild large herbivores do not have access to running water during cold winter periods, and must fulfil their water requirements consuming snow. Also farm animal species like sheep and cattle kept in large enclosures or on pasture during winter seem to manage well with snow as their free water source, for lengthy periods (*Degen & Young* 1981, *Degen & Young* 1990). Horses do occasionally ingest snow

(Scheibe et al. 1998), but it is not known whether snow may substitute liquid water without detrimental effects on fluid balance.

Case details

History

Due to extreme winter conditions the supply of drinking water for a flock of young Icelandic horses failed. For several days in December 2002, the only source of free water for the horses was to ingest snow. The 40 horses were kept permanently outdoors during winter, in an enclosure with a simple shelter on a private farm located in an inland area of Norway, latitude 62°15', altitude 600 m. Mean air temperature, according to official figures for the area, is for the five months long period from November through March -9.8°C and may in mid winter be as low as -40°C . The horses had free access to grass silage with a dry matter content of $>30\%$, which keep the feed easily edible also at low temperatures. Water was provided from a natural beck running through the area, equipped with an electric heater to prevent freezing. A preceding dry autumn resulted in less flow of water than normal in the beck, and after a period of severe cold, the water froze from December 8th to December 20th. The horses had frequently been observed to ingest snow also when running water was readily available. Hence, the enclosure was extended with a field of 10 ha covered with a 20 cm layer of snow during this period.

Sampling

These horses were included in a larger experiment running for three years with the main aim of studying the effect of harsh winter conditions, in particular low ambient temperatures, on the use of shelter (Mejdell & Bøe 2004). A control of fluid balance was part of this project. Blood samples were collected by Venoject® sterile heparin 10 ml vacutainers from the jugu-

lar vein of the same six randomly chosen horses at October 21st and December 28th year 2001, and March 2nd, May 20th, November 3rd, and December 17th (after 9 days with snow as their only source of water) year 2002. The horses were kept on a halter during blood sampling. Heparin vacutainers were then left in room temperature until the next morning, when plasma was extracted and stored at -20°C . Samples were delivered frozen to the Central Laboratory, Norwegian School of Veterinary Science, Oslo, and analysed for osmolality (moles of solute per kilogram of solvent) by freezing-point depression by means of standard procedures at the laboratory.

Clinical observations and laboratory results

During the period when snow was the only source of free water, the general appearance of the horses remained unaffected. Access to the larger enclosure made the horses run and play. The feed consumption was apparently not changed, as judged by the number of horses observed around the feeding rack and the need for refilling of grass silage. However, there was no exact recording (weighing) of the feed intake. At December 17th, after blood sampling, the horses were subjected to a simple clinical veterinary examination (general condition, including skin turgor) which did not reveal any clinical signs of disease or dehydration. Then, all horses were let into compartments with drinking bowls, equipment that they were familiar with. The horses showed very little interest for the bowls. Only a few horses drank, and no horses spent more than a few seconds drinking. Aggressive interactions near the drinking bowls were not observed.

A one-way ANOVA was used to analyse the data for osmolality, and Student Newman-Keulst-test was used to compare means. Plasma osmolality differed significantly between two of the samplings ($P<0.001$), as indi-

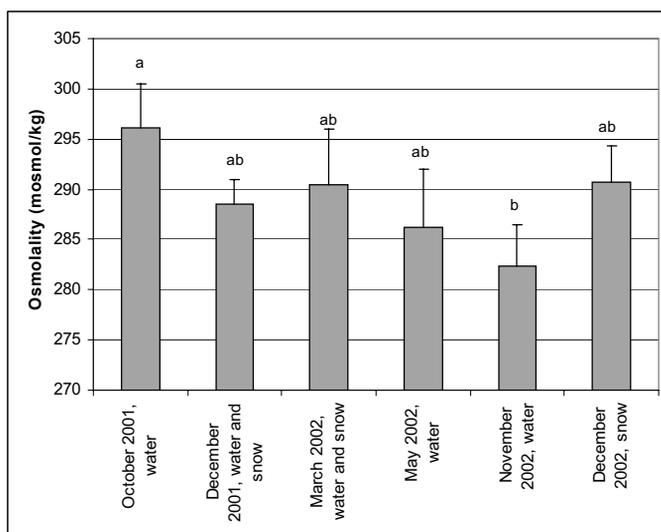


Figure 1: Plasma osmolality (mean \pm sd) for the six horses for the six samplings. Means with different superscripts differ significantly (a,b $P < 0.001$).

cated in Figure 1. However, the highest mean value occurred in October 2001, and not in the period with no access to liquid water in December 2002 (Fig. 1). Across samplings, all individual values varied between 277 and 304 mosmol/kg. At December 17th the range was 287-295 mosmol/kg.

Discussion

The nine days long period with snow as the only source of free water did not result in an increase in mean plasma osmolality, compared to former tests taken of the same horses when liquid water had been available. At December 17th individual values were well within the normal range for osmolality which is 270-300 mosmol/kg (Boon & Rebar 1988). In comparison, Houpt *et al.* (2000) reported an increase in plasma osmolality of 10 and 17 mosmol/kg for stalled ponies, which were water deprived for 19 and 36 hours, respectively. Friend (2000) found an increase from 280 to 340 mosmol/kg when horses were either transported or simply left in

a paddock for 22 hours without water in hot summer weather. Analysis for plasma Na^+ and urine specific weight, which would have given additional, supportive information, was not performed.

Water deprived horses usually reduce their voluntary feed intake (Sneddon *et al.* 1991). In this case, the feed intake seemed unchanged. Even relatively dry grass silage contains considerably water, the ambient temperature was low, and thus, the water demand that had to be covered by ingestion of snow was relatively little. The incidence of drinking (i.e. head by the beck) in this flock was on average 0.75%, range 0-2.5% on 23 observations between 16.00 and 24.00 h in winter.

The behaviour when the horses got access to water bowls indicates that they did not feel thirsty. Also, the horses' general appearance (behaviour and clinical examination) indicates that they did not have problems to cope with the situation.

However, in hind gut fermenters like the horse,

the gastrointestinal tract acts as a fluid reservoir during dehydration and rehydration (Sneddon & Argenzio 1998), which could delay the physiological signs of a dehydration.

In conclusion, osmolality levels as well as drinking behaviour and general appearance suggest that in cold weather, horses being fed grass silage and adjusted to eat snow, can manage for several days with snow substituting liquid water, without their physiology and welfare being challenged.

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Sammendrag

En flokk vinterakklimatiserte islandshester i utedrift hadde i over en uke snø som eneste vannkilde, etter at drikkevannskilden frøs. Endringer i fôropptaket (rundballensilert gras) kunne ikke observeres i denne perioden. Etter ni dager ble hestene tilbudt drikkevann. Hestene viste da ingen spesiell interesse for å drikke. Det ble foretatt en enkel klinisk undersøkelse av hestene, og allmentilstanden ble vurdert som normal. Blodprøver, som ble tatt like før hestene fikk adgang til vann, ble analysert for plasma osmolalitet. Disse lå innenfor referanseområdet, og det ble ikke påvist signifikante endringer i forhold til prøver som tidligere var tatt av de samme individene, mens de hadde tilgang til drikkevann. Dette tyder på at utegående hester som føres med surfôr og er vant med snø, kan klare seg i perioder om vinteren med snø i stedet for drikkevann, uten at deres velferd er truet.

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