Effect of snow as a water source on beef cows and their calf production

Young, B. A. and Degen, A. A. 1991. **Effect of snow as a water source on beef cows and their calf production.** Can. J. Anim. Sci. 71: 585–588. Individually (n = 21) and group-fed (n = 100 over two winters) beef cows were either denied water in winter when snow was available or had free access to water. There was no difference in body mass or subcutaneous fat depth between the two treatments nor was there any difference in the birth or weaning body masses of their calves. It was concluded that beef cows could rely on snow as a water source during winter.

Key words: Beef cows, snow consumption, body mass change, calf production

Young, B. A. et Degen, A. A. 1991. **Abreuvement des vaches d'élevage de boucherie et de leurs veaux avec de la neige.** Can. J. Anim. Sci. 71: 585–588. Des vaches d'élevage de boucherie nourries individuellement (n = 21) ou collectivement (n = 100 pendant deux hivers) ont soit été privées d'eau en hiver parce qu'il y avait de la neige ou avaient librement accès à un point d'eau. On n'a noté aucune variation de la masse corporelle ni de l'épaisseur de la couche de graisse sous-cutanée entre les deux traitements, ni constaté d'écart dans le poids des veaux à la naissance ou au sevrage. On en conclut que les vaches d'élevage de boucherie peuvent s'abreuver avec de la neige en hiver.

Mots clés: Vaches d'élevage de boucherie, consommation de neige, modification de la masse, production de veaux

Feral animals often rely on snow as a primary water source. In fact, reindeer preferred snow to water when offered a choice (Luick 1977). This was not the case with cattle which preferred water when given the same choice (Degen and Young 1984). However, domestic animals such as steers (Young and Degen 1980), pregnant cows (Degen and Young 1990a), sheep (Weeth et al. 1959; Butcher 1973), lactating ewes (Degen and Young 1981), growing calves (Degen and Young 1990b) and horses (Deiterich and Holleman 1973) can also rely on snow as their sole water source without any apparent detrimental affects. Indeed, some commercial ranchers in Western Canada (personal observations) and Utah (J. E. Butcher, personal communication) use snow as a primary water source for their cattle during the winter.

In this study, we measured changes in body mass and subcutaneous fat of pregnant beef cows consuming snow, and compared these results with those of cows that had free access to water. Furthermore, we examined whether snow consumption by pregnant cows had a subsequent effect on (1) birth and weaning body masses of their calves and (2) the time it took for the cows to conceive following calving. The studies were made at Kinsella, Alberta, an area characterized by cold winters. Beef cows that were used were aged 3.5–5.5 yr of Hereford, beef synthetic and dairy synthetic strains selected from the University's research herd. All cows in the herd, including those used in experiments were routinely weighed in early March and late October each year. Conception date of each cow was calculated as calving date minus 286 d.

Experiment 1.

Twenty-one pregnant cows were divided randomly into two body weight and breed-matched groups on 28 Nov. The cows were fed individually in adjacent outside stalls and offered a ration of 3.5 kg timothy hay (92.6% DM; 12.6% crude protein; 39% ADF) and 3.5 kg barley grain (88.3% DM;

11.6% crude protein) between 08:00 and 09:30 h daily. Water was available free choice. Following the first snowfall that remained on the ground (9 Jan. till 19 Mar.) the cows were allocated to one of two groups: (1) continuous access to water from a heated (10°C) water bowl (water cows; $n = 10$), no access to water, but access to snow (snow cows; $n = 11$). When not feeding, the cows were maintained in two small fields adjacent to the feeding stalls during which time snow was always available. Surrounding trees and a porosity fence provided some shelter from wind; however, no bedding or other protection from inclement weather was available.

The cows were weighed at weekly intervals before the daily feeding. In addition, subcutaneous fat depth was measured at the 12th–13th rib of each cow at the beginning and end of the experimental period using an ultrasonic probe.

All cows usually consumed their rations. When the daily ration was not totally consumed in the allotted feeding period, remains were left in the trough. These remains were consumed at a subsequent feeding and on no occasion did feed remain for more than 3 consecutive days.

Although the cows consumed all the feed offered, they lost body mass at an average of 0.56 kg d^{-1} during the first part of the winter (October to 9 January). During the first 7 d (9–16 Jan.) of the treatment period, the cows with access to water gained 14.4 kg while the cows on the snow treatment lost 7.7 kg. The loss in body mass in the snow treatment was presumably due to an initial decrease in water intake resulting in a decreased rumen fluid volume. Other ruminants such as sheep (Degen and Young 1980a) and goats (Thompson et al. 1980) reduced their water intakes when suddenly exposed to cold and this results, at least in sheep, in mainly a reduced rumen volume. This may have occurred in the cows in the present study. However, over the whole treatment period (69 d), both groups of cows gained body mass and the average increases were similar (Table 1). Subcutaneous fat depth decreased in both groups, and there was no significant treatment effect. The observed losses in subcutaneous fat occurred concomitantly with increases in body mass. This can be explained by changes in body composition, in particular increased total body water volume, in pregnant cows (Degen and Young 1980b). The similar changes in body mass and subcutaneous fat in the two groups indicate that no extra energy was required to melt the snow and bring the water to body temperature. This would support the suggestion by Butcher (1973) that the heat produced from the digestion of feed and the heat increment of feeding is more than adequate for this purpose.

Table 1. Change (Δ) in body mass and subcutaneous fat depth in individually fed cows with access to water (water; $n = 10$) or denied access to water but with access to snow (snow; $n = 11$). Included in the table are the number of days between calving and conception (days open) and weaning body mass of the calves of these two cow groups

	Water	Snow	Sig.[z]	SEM
Body mass (kg)				
9 January	473	478	NS	2.63
19 March	509	521	NS	2.59
Δ body mass (9 Jan.–19 Mar.)	+36.3	+42.9	NS	2.31
Δ body mass (October–March)	−8.3	−6.8	NS	2.51
Subcutaneous fat depth (mm)				
9 January	4.0	4.3	NS	0.61
19 March	1.8	2.8	NS	0.52
Δ subcutaneous fat depth	2.2	1.5	NS	0.49
Days open	78.9	79.6	NS	0.02
Weaning body mass of calves (kg)	245	242	NS	2.54

[z]Level of significance between groups; NS = not significant.

Experiment II

One hundred pregnant cows (expected calving mid-April) were separated into two matched age and breed groups of 50 cows in each of 2 consecutive years. From the first snowfall that remained (in January) until the snow melted (in March) one group had continuous access to water and one group was denied water. Except for the experimental treatments, both groups of cows were managed and received rations similar to that of the main University research herd. The cows were group-fed and each cow received an average of 3.05 kg grain mixture, 2.79 kg hay and 1.79 kg straw daily. Body mass changes (October–March) in the two groups of cows were not significantly different from each other, −14.5 kg and −15.6 kg for the water and snow treatment, respectively). Similarly, birth (38.4 vs. 38.0 kg; SEM = 0.35 kg) and weaning body masses of their calves (238 vs. 235 kg; SEM = 1.75 kg) were not different. However, the period between calving and conception the following summer (SEM = 1.46; $P<0.05$) was slightly longer (76.5 d) in the water treatment cows than in the cows relying on snow (70.6 d).

On the 2nd and 3rd d of treatment, chinook conditions during the first winter raised air temperatures to an unusually warm high of 11°C. During these 2 d some water was available on the ground in the field due to the melting of snow. Eating of snow was not observed by herdsman in any of the cows till the 3rd day on the snow treatment when two cows were observed eating snow. By the 4th day, air temperature dropped to −18°C and by the 5th day to −30°C. On the 4th day, 10 of the 50 snow treatment cows were observed to be readily eating snow and by the 5th day none of the cows hesitated to eat snow. During the 2nd year, the cows did not hesitate to eat snow.

No constant pattern of drinking water was identified among the cows with access to water and some of the cows with access to water were observed eating snow. Bouts of snow eating by the cows denied water were evident shortly after sunrise each morning and after the mid-day feeding period. This pattern of eating snow may be important in determining the thermal stress of the cow. Rapid ingestion of large volumes of snow resulted in decreased rumen and rectal temperatures and in increased metabolic heat production (Degen and Young 1984). However, in sheep consuming snow at a slow rate, as was evident with the cows in the present study, the drop in rumen temperature was actually less than that measured in sheep drinking cold water (Sims and Butcher 1966). Cows showed a preference for clean snow which could easily be picked up with a circular scooping motion of the tongue similar to that used in grazing. Areas of trampled, wind-blown or crusty snow tended to be avoided. The duration of snow eating bouts was dependent upon air temperature. On warmer days both groups of cows tended to be dispersed over the field and snow eating by the cows was prolonged considerably more than during colder days. On days colder than −20°C the cows tended to spend substantial time standing huddled together in areas sheltered from the wind.

We concluded that the performance of cows that relied on snow as a water source was similar to that of cows with free access to water. This may provide an important management option to farmers in winter when snow is available but the provision of water is difficult or expensive.

The study was supported in part by grants from the Agricultural Research Council of Alberta and the Natural Sciences and Engineering Research Council of Canada.

Butcher, J. E. 1973. Snow as the only source of water for sheep. Pages 205–209 *in* H. F. Mayland, ed. Proceedings of Symposium on Water-Animal Relations. University of Idaho Press, Kimberly, ID.

Degen, A. A. and Young, B. A. 1980a. Effect of cold exposure on liveweight and body fluid compartments in sheep. Can. J. Anim. Sci. **60**: 33–41.

Degen, A. A. and Young, B. A. 1980b. Liveweight, total body-water and maternal body solid changes in pregnant and lactating beef cows. J. Agric. Sci. (Camb.) **95**: 1–5.

Degen, A. A. and Young, B. A. 1981. Response of lactating ewes to snow as a source of water. Can. J. Anim. Sci. **61**: 73–79.

Degen, A. A. and Young, B. A. 1984. Effects of ingestion of warm, cold and frozen water on the heat balance in cattle. Can. J. Anim. Sci. **64**: 73–80.

Degen, A. A. and Young, B. A. 1990a. The performance of pregnant beef cows relying on snow as a water source. Can. J. Anim. Sci. **70**: 507–515.

Degen, A. A. and Young, B. A. 1990b. Average daily gain and water intake in growing beef calves offered snow as a water source. Can. J. Anim. Sci. **70**: 711–714.

Dieterich, R. A. and Holleman, D. F. 1973. Haematology, biochemistry and physiology of environmentally stressed horses. Can. J. Zool. **51**: 867–873.

Luick, J. R. 1977. Preference of reindeer for various physical and chemical forms of water. Pages 66–68 *in* Industrial development in Alaska and its effects on the nutritional and physiological status of arctic animals — Progress Report. Institute of Arctic Biology, University of Alaska, Fairbanks, AK.

Sims, P. L. and Butcher, J. E. 1966. Water source effects on rumen temperature. J. Anim. Sci. **26**: 590 (Abstr.).

Thomson, E. M., Forshing, M. L. and Thompson, D. W. 1980. The effect of cold exposure on fluid balance, circulating arginine vasopressin concentration and milk secretion in the goat. Pflugers Arch. **383**: 241–244.

Weeth, H. J., Torell, C. R. and Cassard, D. W. 1959. Effects of simulated snowbound stress condition on ewes. J. Anim. Sci. **18**: 694–700.

Young, B. A. and Degen, A. A. 1980. Ingestion of snow by cattle. J. Anim. Sci. **51**: 811–815.

B. A. Young and A. A. Degen[1]

Department of Animal Science, University of Alberta, Edmonton, Alberta, Canada T6G 2P5. *Received 1 Nov. 1990, accepted 6 Feb. 1991.*

[1]*Permanent address (A.A.D.): Isan Centre for Comparative Medicine and Desert Animal Research, Jacob Blaustein Institute for Desert Research, Ben-Guiron University of the Negev, Beer Sheva, Israel 84105.*