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Effects of outdoor winter housing and feeding level on performance and blood metabolites of suckler cows fed whole-crop barley silage

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Abstract

The experiment studied the effects of long-term cold climatic housing conditions at a latitude of 62°N on pregnant Hereford cows and their progeny. Thirty-five cows in their third parity were overwintered in outdoor facilities with either a rain-shelter or a three-wall shelter, or in an uninsulated barn. Whole-crop barley silage was offered to the cows either *ad libitum* or restricted supplemented with oats. The dry matter intake on the restricted diet was 75% of that on the *ad libitum* diet. The cow live weight (LW) averaged 670 kg at the onset of the experiment. During winter the cows outdoors on the restricted diet maintained their LW while those on the *ad libitum* diet gained LW ($P<0.05$, − 3 *vs*. 41 kg). On pasture, the LW gain (LWG) was 61 and 32 kg ($P<0.05$) for the cows overwintered outdoors on the restricted and on the *ad libitum* diets, respectively. The initial body condition score (BCS, Scale: 0–5) of the cows averaged 2.90. During winter the cows outdoors on the restricted diet decreased and those on the *ad libitum* diet increased the BCS ($P<0.01$, − 0.14 *vs*. 0.21). On pasture, the cows overwintered outdoors on the restricted diet increased the BCS more than those overwintered on the *ad libitum* diet ($P<0.05$, 0.31 *vs*. 0.08). No signs of extraordinary stress, massive consumption of energy stores, frequent muscle injuries or severe inflammations occurred in any of the groups according to blood analyses of cows, *e.g.* cortisol, long-chain fatty acids, aspartate aminotransferase, creatine kinase and white blood cell count. The calving period was from 11 March to 21 April. Only one indoor calving was classified as difficult due to faulty disposition leading to the loss of the calf. All outdoor calvings were easy. The LWG of the indoor calves of cows on the *ad libitum* diet was poorer ($P<0.05$) pre the grazing period than that of the outdoor calves of cows on the *ad libitum* diet. On pasture and during the entire experiment the LWG was similar for all calves, averaging 1335 and 1251 g/d, respectively. The breeding season was 82 days. Thirty cows out of 33 were observed to be pregnant after the mating period. All the facilities offered adequate shelter for the mature, pregnant suckler cows. The restricted offering of whole-crop barley silage provided, on average, 101 MJ metabolizable energy/d and gave enough energy for the cows.

Keywords: Blood metabolites; Claw; Housing; Suckler cow; Whole-crop barley silage

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1. Introduction

Winter housing expenses play a considerable role in northern latitudes where insulated winter buildings are typically used not only for dairy cows and growing cattle but also for suckler cows. Rising housing costs have created a demand for inexpensive winter housing systems. One method of reducing costs is to winter suckler cows outdoors. Suckler cows have lower demands for housing facilities and feeding than high-producing dairy cows.

The effects of cold climatic conditions on the performance and welfare of growing cattle are well-documented. In most cases, cold conditions or absence of shelters have affected animal performance negatively (*e.g.* Birkelo et al., 1991; Delfino and Mathison, 1991; Kubisch et al., 1991) or have changed animal behaviour (Redbo et al., 2001). On the contrary, McCarrick and Drennan (1972a,b) and Redbo et al. (1996) reported no negative effects on animal health and live weight gain. According to Malechek and Smith (1976), Hereford cows altered their daily behavioural routines in response to changes in weather conditions, when little natural and no artificial shelter were provided. However, the effects of outdoor wintering on the performance of mature suckler cows and especially on cow physiology are less well documented. Wassmuth et al. (1999) reported that suckler cows in severe weather conditions reduce their motor activity and remain near the feeding point.

According to Lowman (1997) feed costs account for about 75% of the total variable costs for both autumn and spring calving herds. Furthermore, 80% of total feed costs are aroused by the cow herself. Therefore, the possibility to restrict the amount of winter feed without detrimental effects on cow or calf performance is essential in reducing production costs. In northern latitudes where year-round grazing is not possible, winter feeding of suckler cows is generally based on inexpensive or alternative feeds such as straw, treated straw, feed industry by-products or whole-crop cereal silages (Manninen et al., 2000, 2004, 2005). In cold conditions, whole-crop cereal silage has proved to be an acceptable winter feed for suckler cows due to its non-freezing property (Manninen et al., 2005). Using pregnant beef cows Young (1975) studied the effects of winter acclimatization on the energy metabolism of mature cows and concluded that the metabolic rate was not significantly influenced by either the body condition or by the availability of bedding. Information on the effects of long-term cold climatic conditions on the blood parameters of mature, pregnant suckler cows is, to our knowledge, not available.

In the present study, the purpose of comparing the feeding strategies was to study whether the mature suckler cows can be kept on restricted amounts of feeds without detrimental effects of cold. The working hypothesis of the present study was that mature, pregnant spring-calving suckler cows can be overwintered outdoors in a cold climatic environment in inexpensive housing facilities on restricted amounts of feeds without negative effects on body weight and condition score, calving difficulty of dams and on the growth of their calves. Selected blood analyses were presumed to be more sensitive indicators than production performance to detect any signs of subclinical infections, imbalance in energy metabolism or uncomfortableness caused by cold housing conditions and feed restriction. The present study evaluated the effects of long-term cold conditions on Hereford cows and their progeny overwintered in different housing facilities and offered whole-crop barley silage (WCBS) either *ad libitum* or restricted supplemented with oats. The effects were studied by evaluating the cow and calf live weight, cow body condition, dystocial cases, cow maternal instincts, reproduction, claw health and blood constituents.

2. Material and methods

2.1. Animals and experimental design

Thirty-five Hereford (Hf) cows with an initial live weight (LW) of 670 kg (Standard Deviation, S.D., 71.6) and body condition score (BCS, Scale: 0–5) of 2.90 (S.D. 0.319) on 2 November were selected for the experiment. The animals comprised 33 third-calving and two second-calving cows, all born in the same year and pregnant to a Hf bull. The experiment consisted of two main periods, a winter feeding period and a grazing period averaging 212 (S.D. 0.5) and 94 (S.D. 0.5) days, respectively. The experiment commenced on 3 November and the grazing season started on 2 June. The experiment ended with the weaning of the calves on 4 September. There were seven animals per treatment. The five treatments imposed on the cows during the winter period were:

I) outdoors with a rain-shelter having *ad libitum* WCBS (AS)
II) outdoors with a rain-shelter having restricted WCBS (RS)
III) outdoors with a three-wall shelter having *ad libitum* WCBS (AT)
IV) outdoors with a three-wall shelter having restricted WCBS (RT)
V) indoors having *ad libitum* WCBS (AU).

The treatment Indoors and having restricted WCBS is missing due to lack of housing facilities. The predicted calving date (gestational age assessed by ultrasonographic foetometry after natural mating), initial LW and BCS (Scale: 0–5) were