

# Effects of diet during the first winter on replacement heifer weight gain and body condition score during the subsequent grazing season

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## Introduction

In seasonal calving dairy production systems it is important that heifers attain puberty in an appropriate timeframe especially when they are bred to calve at 2 years of age and in systems that impose restricted breeding periods (Ferrell, 1982). Achieving target weights at key time points is critical because, for example, the onset of puberty usually occurs in dairy heifers at 30-40% of their expected mature BW (Heinrichs 1993) which corresponds to approximately 240-320 kg in Holstein heifers. Furthermore, heifers should be managed to achieve 55% to 60% of mature bodyweight (BW) at mating start date (MSD; Patterson *et al.* 1992). Archbold *et al.* (2012) has shown that both heifer BW and body condition score (BCS) at MSD are positively associated with calving date and potential milk fat plus milk protein yield when they enter the lactating herd. Heifer rearing is the second largest expense in the dairy system, accounting for approximately 20% of total costs (Gabler *et al.* 2000). Therefore, it is necessary to focus on reducing costs of production, particularly feed costs, as they account for approximately 80% of total variable costs (Shalloo *et al.*, 2004). One of the methods of reducing feed costs in particular, is by sourcing lower cost feeds. Finneran *et al.* (2010) reported that kale grazed *in-situ* ranked as the cheapest alternative to grazed grass and was considerably cheaper than grass silage. Kale has higher crude protein (CP) content than grass silage (Keogh *et al.* 2009) and may be suitable for inclusion in the diet of replacement dairy heifers. However, kale also tends to have a low neutral-detergent fibre (NDF) concentration (Keogh *et al.* 2009) suggesting that feeds with a higher NDF concentration (>500 g/kg DM), such as silage may need to be offered in order to avoid acidosis. The objectives of this study were to i) investigate five contrasting winter feeding regimes on heifer bodyweight (BW) gain and body condition score (BCS), ii) establish if similar BW gain is achieved from a kale only diet compared to a kale + grass silage diet and iii) determine if compensatory growth during the following grazing season exists in replacement heifer rearing systems.

## Methods

One hundred and fifty spring born weanling replacement dairy heifer calves were balanced on the basis of breed

(Holstein Friesian; 79% of herd, Jersey × Holstein; 13% of herd, Montbelliarde × Holstein; 9% of herd), age ( $284 \pm 20.3$  days), bodyweight (BW;  $213 \pm 26.1$  kg) and body condition score (BCS;  $2.98 \pm 0.215$ ) in a randomised block design. They were then randomly assigned to one of five winter feeding treatments from 23 November 2009 to 25 February 2010 (94 days).

The five feeding treatments were: (1) indoors offered *ad libitum* grass silage and 1.5 kg DM concentrate (IC); (2) indoors offered *ad libitum* grass silage only (SO); (3) outdoors on an out-wintering pad offered *ad libitum* grass silage and 1.5 kg DM concentrate (OWP); (4) outdoors offered 70% kale and 30% grass silage (70K); and (5) outdoors offered 100% kale (100K). The IC, SO and OWP treatments were all offered the same silage. The 70K animals were offered baled silage. The forage kale was grazed *in situ*.

Prior to the commencement of the experiment all animals received one Tracesure<sup>®</sup> I bolus to provide iodine, selenium and cobalt supplementation; they had previously been supplemented with Cu. The 100K treatment animals were offered straw for the first week of the study to adjust them to the 100% kale diet. It was intended to offer no further fibre source after the first week, however due to continuous frost, 3 bales of silage were offered during week 5 of the experiment. All animals were offered fresh feed daily; the refusals of the IC, SO and OWP animals were removed and weighed daily. The outdoor animals were offered a fresh allocation of kale each morning by moving a temporary electric fence. All treatments were grouped individually.

During the experimental period all animals were weighed weekly and condition scored every three weeks. All animals were turned out to pasture on 25 February and offered *ad libitum* grazed grass. All animals were then weighed weekly to the start of the breeding season (15 April) and monthly thereafter, while BCS was recorded monthly from turnout. All data were analysed using PROC MIXED in SAS. Animal was used as the experimental unit. Pre-experimental values were used as a co-variate in the model. The data are reported in three periods, PI: the 94 day experimental period, PII: the period of time from turnout to the start of the breeding season and PIII: from after the commencement of the breeding season to 6 September 2010.

**Table 1. Effects of winter feeding treatment on bodyweight (BW) and body condition score (BCS)**

	IC	SO	OWP	70K	100K	SED	Sig
BW gain PI	0.41 a	0.29 b	0.52 a	0.47 a	0.51 a	0.037	0.011
BW gain PII	0.68	0.82	0.73	0.78	0.72	0.054	0.536
BW gain PIII	0.80	0.93	0.81	0.82	0.80	0.027	0.111
Average BCS PI	3.10 ab	3.07 ab	3.13 b	3.05 a	2.97 c	0.023	0.009
Average BCS PII	3.15	3.16	3.15	3.22	3.18	0.041	0.757
Average BCS PIII	3.05	3.12	3.10	3.09	3.07	0.031	0.6832

abc values in the same row not sharing a common superscript are significantly different

## Results and Discussion

The DMD of the pit silage was 70 ( $\pm 2.0$ ) %, dry matter (DM) was 28.7 ( $\pm 2.49$ ) % and crude protein (CP) was 11.0 ( $\pm 0.07$ ) %. The DMD of the baled silage was 70 ( $\pm 2.5$ ) %, DM was 34.2 ( $\pm 6.69$ ) % and CP was 15.6 ( $\pm 0.66$ ) %. The BW gain during the period when treatments were imposed (PI) was similar for the IC, OWP, 70K and 100K treatments (0.48 kg/day; Table 1). The SO treatment gained significantly less BW during PI ( $P < 0.01$ ; 0.29 kg/day) than all other treatments. There was no significant difference between treatments in BW gain throughout PII and PIII (0.75 and 0.83 kg/day, respectively), clearly indicating that no compensatory growth was achieved by animals in the SO treatment post turnout. During PI BCS was lowest ( $P < 0.01$ ) for the 100K animals (2.97; Table 1) which was probably a consequence of prevailing weather conditions during the experiment. Mean air temperatures during the experimental period were 2.9°C, 3.6°C and 2.8°C lower than the 10-year average in December (6.1°C), January (5.8°C) and February (5.8°C), respectively. As frosted brassicas should not be offered for consumption the BCS of the animals from 100K treatments may have suffered due to feed restriction. However, during PII and PIII there was no effect of winter treatment on average BCS indicating that the 100K animals compensated.

## Conclusion

The results from this study indicate winter feeding treatment significantly affects BW gain. Similar over-winter BW gain was achieved with 70% kale and 30% grass silage compared to 100% kale diets, indicating that replacement heifers can be offered a kale only diet for up to 94 days. Where kale was used as a winter feed BW gains

similar to silage and concentrate based diets were achieved. Furthermore, the concept of 'compensatory growth' cannot be relied upon when trying to get replacement heifers to attain target weight at breeding start date.

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