

## The effect of growth rate on age at first calving, fertility and milk production during the first lactation of Holstein-Friesian heifers on UK dairy farms

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**Introduction** Rearing heifer replacements that reach first calving at an age and body weight (BW) to achieve their full lifetime potential, in terms of both yield and profitability, is a key factor in dairy enterprises. Rate of growth during the rearing period has a direct effect on age at first calving (AFC) (Heinrichs, 1993). It is widely accepted that the average daily gain (ADG) of Holstein-Friesian heifers should be approximately 0.7 kg/d before puberty, and 0.8 kg/d after. However, we have previously found extreme variability in the ADG of calves both within and between commercial dairy farms; this may in part be due to the very limited use of weight or height measurements on most farms. The aim of the present study was to determine the effect of growth rate during the first six months of life on AFC, and subsequent fertility and milk production during first lactation of Holstein-Friesian heifers on UK dairy farms.

**Materials and methods** A total of 17 dairy farms across southern England milking Holstein-Friesian cows were recruited during 2003-04, providing a range of management practices representative of those commonly encountered in the UK. For heifer calves recruited, BW was measured at one ( $28 \pm 0.8$  d) and six months ( $184 \pm 0.8$  d) of age, to calculate the ADG from one to six months. Heart girth and height at withers were measured at one to two wks before first calving. After calving, measures of fertility (AFC, days to commencement of luteal activity (CLA), days to conception (DTC), and services per conception (S/C)) and milk production (days in milk (DIM), milk per d, 305 d yield and total milk yield) were recorded. Animals with complete growth, fertility and milk production records ( $n=283$ ) were subdivided on the basis of their pre-pubertal ADG; (i)  $<0.6$  kg/d ( $n=69$ ), (ii)  $0.6-0.8$  kg/d ( $n=91$ ) and (iii)  $>0.8$  kg/d ( $n=123$ ). One-way analysis of variance (ANOVA) and the post-hoc tukey test were used to compare the size, fertility and milk production traits between these groups. All data were tested for homogeneity of variance and log transformed if necessary. Chi-square analysis was used to compare the proportion of animals pregnant 200 d after calving between the three groups.

**Results** The ADG from one to six months was  $0.76 \pm 0.01$  kg/d (range per calf 0.26 to 1.23 kg/d), and the mean AFC was  $26.0 \pm 0.2$  months (range 21 to 40 months). Fertility and milk production traits during the first lactation according to ADG are presented in Table 1. Heifers with an ADG of  $<0.6$  kg/d were smaller but on average three months older at first calving compared to those with an ADG of  $>0.8$  kg/d ( $P<0.001-0.01$ ). After calving, these smaller but older animals tended to have a longer interval to the CLA ( $P<0.1$ ); heifers with the shortest interval to the CLA had an ADG of  $0.6-0.8$  kg/d. There was no significant difference in the number of DTC or S/C between the three groups ( $P>0.15$ ), but a larger proportion of animals with an ADG of  $0.6-0.8$  and  $>0.8$  kg/d were pregnant by 200 d ( $P<0.05$ ). First lactation milk production was not significantly different between the three groups, although heifers with an ADG of  $>0.8$  kg/d tended to produce less milk ( $P<0.15$ ). An additional 19 heifers failed to conceive as a maiden heifer ( $<0.6$  kg/d: 3%,  $0.6-0.8$  kg/d: 4%, and  $>0.8$  kg/d: 5%) and 24 during first lactation ( $<0.6$  kg/d: 5%,  $0.6-0.8$  kg/d: 8%, and  $>0.8$  kg/d: 6%).

**Table 1** Mean ( $\pm$ SEM) size at first calving, fertility & milk production traits during first lactation of 283 heifers according to ADG;  $<0.6$  kg/d,  $0.6-0.8$  kg/d &  $>0.8$  kg/d. +within rows a<b. NS=not significant  $P>0.15$

Parameter		ADG (kg/d)			P-Value+
		<0.6	0.6-0.8	>0.8	
Size before calving	Girth (cm)	$198 \pm 1^a$	$203 \pm 1^b$	$203 \pm 0.6^b$	0.001
	Height (cm)	$137 \pm 0.8^a$	$139 \pm 0.7$	$141 \pm 0.4^b$	0.001
Fertility	AFC (months)	$28 \pm 0.5^b$	$26 \pm 0.2$	$25 \pm 0.3^a$	0.01
	CLA (days)	$34 \pm 4^b$	$24 \pm 2^a$	$26 \pm 1$	0.06
	DTC	$148 \pm 13$	$132 \pm 9$	$123 \pm 7$	NS
	% pregnant at 200d	75%	85%	89%	0.04
	S/C	$2.3 \pm 0.3$	$2.5 \pm 0.2$	$2.3 \pm 0.1$	NS
Milk	DIM	$359 \pm 13$	$353 \pm 10$	$341 \pm 7$	NS
	Total milk (kg)	$9857 \pm 510$	$9980 \pm 327$	$9059 \pm 196$	0.11
	Milk/d (kg/d)	$27 \pm 0.7$	$28 \pm 0.6$	$27 \pm 0.4$	NS
	305 d yield (kg)	$9231 \pm 310$	$9122 \pm 232$	$8633 \pm 147$	0.12

**Conclusion** An increased ADG during the first six months of life significantly reduced the AFC; after first calving a larger proportion of these animals were pregnant by 200 d. Increasing ADG, often through high planes of nutrition, presumably increases rearing costs; likewise a low ADG will lengthen the non-productive period. Therefore, we would suggest rearing heifers at a moderate growth rate of between 0.6 and 0.8 kg/d during the first six months of life. More effort should be made within the industry to ensure all heifers within a cohort reach this target.

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### References

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