BRIEF COMMUNICATION: Birth weight of calves born to dairy cows in New Zealand

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Introduction

The expansion of the dairy industry in New Zealand has resulted in increased opportunities for beef production from the dairy herd. Of 4.1 million dairy calves born in 2014, only 26% were required as replacements, leaving more than 3 million calves that could potentially be reared for beef. The majority (56%) of these potential beef calves were processed as veal at less than two weeks of age, and only 836,000 were reared and finished (Cook 2014). This opportunity for increased production of finishing animals from the dairy industry is recognised by many beef cattle breeders, and some breeders are seeking to produce sires that are suitable for use over dairy cows to produce high-quality finishing cattle.

The historical advantage of beef bulls has been to produce a calf of greater value than a calf sired by a dairy bull, and to produce calves that look different to dairy-sired calves so that farmers know with certainty which calves can be considered as replacements for their herd. In a climate of high milk value and relatively low calf value, dairy farmers prioritise days in milk and cow health above potential sale value of calves (Cook 2014). This has resulted in a shift in the dairy industry to using Jersey bulls when historically a beef bull would have been used.

If beef bulls are to return to favour in the dairy herd, they need to be able to compete with dairy bulls in terms of their impact on the cow by producing calves of comparable birth weight. The aim of this paper was to examine the birth weight of calves born to dairy cows that were sired by dairy breed bulls and to determine how they differed for heifer dams compared with mature dams, and for Jersey, Holstein Friesian and Crossbred cows.

Materials and methods

Data was extracted from the LIC database for calves born in New Zealand between 1 January 2010 and 10 October 2014. Data collected included birth date, dam, breed of dam, age of dam, sire, breed of sire, breed of calf, sex, weighing date and weight and fate of calf.

Data handling

Calves with less than 16/16 breed composition recorded or that included breeds other than Holstein Friesian or Jersey were excluded. Breed of calf was defined as Holstein Friesian if it was ≥14/16 Holstein Friesian, and Jersey if it was ≥14/16 Jersey. Calves between these limits were defined as Crossbred. These rules were also applied to dams and sires of calves.

Most of the calves were female (87%), so the male calves were likely to have represented a biased subgroup and were excluded. Weights were restricted to those taken ≤3 days after birth and had to be >0 and ≤100 kg. Calves born outside New Zealand were excluded, as were those without a breeding value for live weight. There was a small number of calves that died or were sold as bobbies and these were also excluded. These limitations left a total of 2197 calves, representing 304 sires in 71 herd/season groups.

A second data set from a population of 281 Holstein Friesian cows in the strain trial (McNaughton et al. 2002) was used. These cows had Jersey-sired (Crossbred) calves at 2 years of age and, in subsequent years, were bred to Holstein Friesian bulls during the artificial breeding period and to Hereford bulls during the natural mating period. In total, 281 Crossbred calves, 261 Holstein Friesian calves and 81 Hereford-cross-Holstein Friesian singleton calves had records for sex, birth weight and birth date and these were used in this analysis.

Statistical methods

Data was analysed using R (R core team, 2013, Vienna, Austria). A linear mixed model that included breed of calf and age of dam (2 years versus ≥3 years) as fixed effects, age at weighing as a covariate and sire and herd/season as random effects was used to compare birth weight of calves by breed of calf. A similar model that included breed of sire and dam instead of breed of calf was used to compare birth weights by breed of dam and by breed of sire and dam.

For the strain trial data, birth weight of male and female Crossbred calves born to 2-year-old dams was compared using a linear model that included the sex of calf, strain of dam and year as fixed effects. A separate linear mixed model was used to compare birth weight of male and female Hereford-cross and straight-bred Holstein Friesian calves. This model included breed of sire, sex of calf, strain of dam, and year as fixed effects, and age of dam (at calving) as a covariate and dam as random effect.

Results and discussion

Jersey calves (28.4±0.8 kg; n=189) were lighter ($P<0.001$) than Crossbred calves (32.2±0.7 kg; n=1278), which were lighter ($P<0.001$) than Holstein Friesian calves (34.6±0.8 kg; n=730). This is consistent with reported mature live weights of 414 kg, 454 kg and 481 kg for Jersey, Crossbred and Holstein Friesian cows, respectively (LIC & DairyNZ 2014). These differences were similar to those

seen for calves born to sires and dams of different breeds (Table 1), in which birth weight increased as breed of sire changed from Jersey to Crossbred to Holstein Friesian ($P<0.001$), and likewise for breed of dam ($P<0.001$).

Table 1 Birth weight (kg) of female dairy calves born to Jersey, Crossbred and Holstein Friesian cows that were 2 years old or ≥3 years old, and sired by Jersey, Crossbred or Holstein Friesian bulls. Values are lsm±sem.

		Breed of dam		
		Jersey	Crossbred	Holstein Friesian
	n	263	1061	749
Age of dam				
2 years	265	28.9 ± 0.9	30.9 ± 0.8	32.5 ± 0.8
≥3 years	1932	30.5 ± 0.8	32.6 ± 0.8	34.1 ± 0.8
Breed of sire				
Jersey	326	27.6 ± 0.8	29.7 ± 0.8	31.2 ± 0.8
Crossbred	845	29.6 ± 0.8	31.7 ± 0.8	33.2 ± 0.8
Holstein Friesian	991	32.5 ± 0.8	34.5 ± 0.8	36.1 ± 0.8

Birth weight of calves was 1.7±0.4 kg greater ($P<0.001$) for ≥3-year-old cows than for 2-year-old cows. This difference likely partially reflects the lower live weight of 2-year-old compared with ≥3-year-old cows (LIC & DairyNZ 2014). Sire breed was fitted into the model, which may have narrowed the gap between 2-year-old and ≥3-year-old cows if Jersey sires were more commonly used over heifers than over cows.

The comparisons among Jersey, Crossbred and Holstein Friesian calves in this experiment included only female calves. Therefore, the birth weights presented are likely to be an underestimate of birth weight for the population. In the strain trial, male Crossbred calves born to 2-year-old heifers weighed 33.8±0.4 kg; 2.2 kg more ($P<0.001$) than their female counterparts, which weighed 31.6±0.4 kg. For the Holstein Friesian- and Hereford-sired calves, the difference in birth weight between male and female calves was 3.4 kg ($P<0.001$; Table 2). This was consistent with previous reports for Simmental- and Angus-sired calves born to Angus and Angus-cross-dairy cows of 3.4 kg (Law et al. 2013), and 2.2 to 3.7 kg for Charolais, Angus, Friesian and Jersey straightbred and crossbred calves (Everitt 1967).

Table 2 Birth weight (kg) of female and male calves born to Holstein Friesian cows that were sired by either Holstein Friesian or Hereford bulls. Values are lsm±sem.

	Breed of sire	
	Holstein Friesian	Hereford
Sex of calf		
Female	38.4 ± 0.5	39.8 ± 0.6
Male	41.8 ± 0.5	43.2 ± 0.6

Hereford-cross-Holstein Friesian calves in the strain trial were 1.4±0.6 kg heavier ($P<0.05$) than Holstein Friesian calves, but the genetic merit of the Hereford bulls used was unknown. A previous experiment using Hereford bulls that were within the lightest 5% of the Hereford population for birth weight, produced calves that were 36.6 kg from 2-year-old Holstein Friesian heifers and 27.1 kg from 2-year-old Jersey heifers (Hickson et al. 2014). Mixed-sex, Hereford-cross-Angus calves in that same experiment weighed 32.9 kg, comparable to calves from 2-year-old Crossbred heifers in the present experiment. Recent reports of mean birth weight in straightbred Angus cattle ranged from 30.7–36.3 kg for calves born to 2-year-old heifers (Hickson et al. 2008, 2009a, b; Morris et al. 2014). This indicates that there are beef bulls in the population that produce calves of comparable, or even lower, birth weight to calves sired by dairy bulls.

In conclusion, the selection of beef bulls with appropriate birthweight breeding values should enable dairy farmers to use beef breed bulls without increasing the birth weight of their calves. This is particularly the case for herds with Holstein Friesian or Crossbred cows, or for herds using these breeds of bulls. Beef bull breeders wishing to produce bulls for use in dairy herds may wish to target calf birth weights that are similar to those for dairy breeds.

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References

Cook A. 2014. The hunt for the missing billion: NZ's dairy beef opportunity. Kellogg Rural Leaders Programme 2014. 27 pp.

Everitt GC. 1967. Birth weights of dairy, beef and dairy-beef calves. Proceedings of the New Zealand Society of Animal Production 27: 73–79.

Hickson RE, Lopez-Villalobos N, Kenyon PR, Morris ST. 2014. Breed effects and heterosis for productivity traits in first calving of Angus, Holstein Friesian, Jersey and crossbred beef cows. Animal Production Science 54: 1381–1387.

Hickson RE, Kenyon PR, Lopez-Villalobos N, Morris ST. 2008. Effects of liveweight gain during pregnancy of 15-month-old Angus heifers on dystocia and birth weight, body dimensions, estimated milk intake and weaning weight of the calves. New Zealand Journal of Agricultural Research 51: 171–180.

Hickson RE, Lopez-Villalobos N, Kenyon PR, Morris ST. 2009a. The effect of liveweight gain of pregnant 15-month-old heifers on the live weight of their first and second calves and milk intake of their first calves. Animal Production Science 49: 112–120.

Hickson RE, Kenyon PR, Lopez-Villalobos N, Morris ST. 2009b. Effects of liveweight gain of 15-month-old Angus heifers during the first trimester of pregnancy on live weight and milk intake of their calves. New Zealand Journal of Agricultural Research 52: 39–46.

Law NL, Hickson RE, Lopez-Villalobos N, Kenyon PR, Morris ST. 2013. Efficiency of beef breeding cows that vary in live weight and milking potential. Proceedings of the New Zealand Society of Animal Production 73: 11–16.

LIC, DairyNZ. 2014. New Zealand dairy statistics 2013-14. Retrieved on 18 January 2015 from: www.dairynz.co.nz/dairystatistics.

Morris ST, Chan FY, Lopez-Villalobos N, Kenyon PR, Garrick DJ, Blair HT. 2014. Growth, feed intake and maternal performance of Angus heifers from high and low feed efficiency selection lines. Animal Production Science 54: 1428–1431.

McNaughton LR, Morgan SR, Gore P, Verkerk GA, Holmes CW, Parkinson TJ. 2002. Monitoring onset of puberty in three genetic strains of Holstein Friesian dairy cattle. Proceedings of the New Zealand Society of Animal Production 62: 30–33.