

VARIABLES ASSOCIATED WITH THE CALVING PATTERN OF PRIMIPAROUS HOLSTEIN-FRIESIAN HEIFERS IN SEASONALLY CALVING HERDS

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The aim of this study was to identify some variables associated with the calving pattern of primiparous Holstein-Friesian heifers as these variables may help understand determinants of reproductive performance of nulliparous heifers. The InCalf Project included a large, prospective, observational field study that described the reproductive performance of 29,462 dairy cows in 168 herds in 9 regions in Australia. In the study described here, a subset of animals from the original study population was selected for further analysis. We selected all primiparous Holstein-Friesian heifers (n=918) in seasonal calving herds (n=35) in the InCalf Project that used AI exclusively for the first 6 weeks of breeding, and that had milk production, sire Australian Breeding Value (ABV) and pre-calving liveweight records. In seasonal calving herds, heifers are mated in groups; the planned start of calving (PSC) date for a group is 282 days after the date that breeding commenced. Thus, the interval between the herd PSC date and each animal's actual calving date (PSC-CI) reflects time to conception. In herds where PSC date was not known, it was estimated based on gestation length distributions in herds where PSC was known. Heifers were categorised into quartiles for each independent variable, and multivariable statistical analyses were performed with herd as a random effect using the PROC MIXED procedure of SAS (SAS 1996).

Table 1. Least square mean ± sem PSC-CI (days) by category of 120-day milk volume, milk fat and milk protein concentrations, and pre-calving liveweight (see text for details).

	Quartile 1 (n=229)	Quartile 2 (n=230)	Quartile 3 (n=229)	Quartile 4 (n=230)
Milk volume ^A (kg)	1185	2303	2596	3069
PSC-CI (days)	19.5 ± 2.2 ^a	16.0 ± 2.1 ^b	15.8 ± 2.1 ^b	11.8 ± 2.3 ^c
Milk fat ^A (%)	3.22	3.58	3.86	4.30
PSC-CI (days)	13.2 ± 2.2 ^a	13.1 ± 2.1 ^a	16.7 ± 2.1 ^b	20.1 ± 2.4 ^b
Milk protein ^A (%)	2.84	3.01	3.14	3.34
PSC-CI (days)	23.0 ± 2.3 ^a	15.6 ± 2.1 ^b	12.9 ± 2.1 ^{bc}	11.6 ± 2.3 ^c
Pre-calving liveweight ^A (kg)	383	441	480	533
PSC-CI (days)	20.7 ± 2.4 ^a	14.8 ± 2.1 ^b	15.4 ± 2.2 ^b	12.2 ± 2.3 ^b

^A While means for the quartiles of each variable are presented, they do not necessarily include the same animals
Values in rows with different superscripts are significantly different (P<0.05)

Heifers that had high early lactation (120-day) milk volume (MV) and milk protein% (MP%), and low milk fat% (MF%), high pre-calving liveweights (PLW) (Table 1), and low sire ABV for milk protein% (SABVP%), had shorter PSC-CIs. Interactions (P<0.05) were detected for MP% x MF%, MP% x PLW and MF% x SABVP%. Observed associations between PSC-CI and early lactation MV, MF% and MP% were likely to be due to biological determinants present before and during the heifer's breeding period that are associated with both reproductive performance in non-lactating dairy heifers, and subsequent milk production/composition in the first lactation. Effects of differences in calving dates of 7-12 days on these variables are likely to be small. The association with SABVP% can be interpreted similarly. Since these associations were evident in non-lactating dairy heifers, the biological determinants causing these associations are not restricted to lactation-specific determinants such as post-partum negative energy balance. Furthermore, these biological determinants are operating in addition to MV, MF%, MP%, SABVP%, PLW and effects of 'herd' as these variables were fitted simultaneously in the multivariable model. Further research is required to identify these determinants. High PLW is probably associated with higher liveweight at breeding, which results in better reproductive performance.

SAS (1996). 'Statistical Analysis System.' (SAS Inst. Inc.: Cary, NC.)

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