

## CESAREAN SECTION IN DAIRY CATTLE: A STUDY OF RISK FACTORS

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The percentage of calves delivered by a cesarean section (C-section) in the Netherlands has increased in recent years because of a more frequent use of double-muscled or beef breed sires. Negative effects on dams that experienced a C-section have been reported (Bouters et al., 1986, Patterson et al., 1981). To reduce the percentage of births by C-section, it is very important to know the risk factors that influence the occurrence. This knowledge also is important in preventing confounding while measuring the negative effects following a C-section.

The purpose of our study was 1) to determine the incidence of C-section calvings on Dutch dairy farms and 2) to identify potential risk factors for C-section in dairy cows.

### MATERIALS AND METHODS

Data were collected routinely on a number of commercial dairy farms around Utrecht, participating in a herd health and production control program of the Department of Herd Health and Reproduction, Veterinary College, University of Utrecht.

A population based case referent study design was used to investigate risk factors for C-section (Miettinen, 1976). The statistical significance level was chosen at  $P = 0.05$ . Conditional logistic regression models were used to estimate the effect of the risk factors while conditioning on farm.

### RESULTS

In the original data set of 15051 calvings, 198 (1,32 %) were C-sections. The percentage of C-sections per farm ranged from 0 to 3.6, resulting in a difference of C-section incidence between farms (Chi-square = 70.676, 34 df,  $P < 0.001$ ). The 198 C-sections were from 186 dams. Ten cows had a C-section twice and one cow three times. Of the 15051 calvings 854 were dystocias and 269 were twin calvings. The mean calving interval was 375 days in the original data set.

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The percentage of gestations ending in a C-section increased considerably during the last two years. Taking the data of the original database, the OR for C-section at calving in 1989 or 1990 (until September) was 1.76 (95 % confidence interval (CI) = 1.30 to 2.37) compared with 1982 to 1988.

No differences were found in cumulative milk production at 100, 270 and 305 days in milk (DIM) in the preceding lactation. After correcting for year and month differences were also not found (100 DIM: P = 0.447, 270 DIM: P = 0.192 and 305 DIM: P = 0.297). The kg of milk produced by the C-section animals during gestation was lower compared to the referent group. The kg of milk produced by the C-section animals during the entire lactation tended to be higher, but their lactation was also longer.

Parity was highly related with C-section (Chi-square = 56.520, 10 df, P < 0.001). The OR of heifers calving by C-section was 3.09 (CI = 2.25 - 4.26) compared to all older cows. Second parity compared with older cows showed no difference (Chi-square = 0.271, 1 df, P = 0.603).

There was a tendency (OR = 1.60, CI = 0.96 to 2.67) for young (< 730 days old) calving heifers to have a higher chance to deliver by C-section compared to heifers older than 729 days at calving.

In the final conditional logistic regression model for heifers, 14 farms could not be included in the analysis. They did not have at least one case and one referent without missing values for the variables included in the model (Table 1). From the 21 farms in the model, 171 heifers were not included because of having at least one variable, that was included in the model, missing. The variables younger than 730 days at calving, male sex of the calf, short gestation and Piedmont sire were included in the final model. No confounding for sex of the calf or breed of the sire was found, though has to be stated that the numbers of cows bred by a Piedmont or double-muscléd sire were small.

In the final conditional logistic regression model for cows, 10 farms could not be included in the analysis, because of not having at least one case and one referent without missing values for the variables included in the model (Table 2). From the 25 farms in the model, 272 cows were not included because of having at least one variable, that was included in the model, missing. The variables male sex of the calf, long gestation period, short dry period, preceding C-section, long interval 1st service - conception and double-muscléd sire were included in the model.

## CONCLUSIONS

At present the most effective ways to minimize the number of C-sections are not to rebreed, or at least rebreed with a sire that produces small calves, cows that delivered by C-section and to avoid the use of Piedmont and double-muscléd sires, especially on

young heifers. The percentage of C-sections also can be minimized by not breeding cows that calved by a dystocia as a heifer with a Piedmont or double-muscled sire. Because the probability of a C-section increased with a longer dry period, it is important not to dry off earlier than 60 days, for high risk animals not earlier than 50 days, before the expected parturition. Because our results may suggest a relation between fatness of the cow at calving and the probability of calving by C-section, prevention of obesity seems advisable. Further research on this is necessary.

Whenever studying the effect of C-section on the subsequent lactation, the risk factors for C-section, especially concerning fertility, have to be taken into account, because they will confound the results.

Table 1. Final conditional logistic regression model on heifers, with 21 Farms with 163 observations

	Coeff.	SE	OR	95 % CI	AP/PF
age at calving < 730d	0.869	0.493	2.39	0.91 - 6.27	0.25
male calf	1.209	0.487	3.35	1.29 - 8.71	0.57
gestation < 280 days	-1.014	0.465	0.36	0.15 - 0.90	0.46
Piedmont sire	1.209	1.16	4.32	0.44 - 41.91	0.08
Deviance = 120.256					
Likelihood ratio statistic on 4 df = 23.655, P < 0.001					

Table 2. Final conditional logistic regression model for cows, including 25 matched farms with 433 observations

	Coeff.	SE	OR	95 % CI	AP/PF
Male calf	2.149	0.488	8.57	3.29-22.33	0.77
Double-muscled sire	2.028	0.780	7.60	1.64-35.06	0.09
Gestation > 287 days	0.984	0.425	2.68	1.16- 6.16	0.19
Dry period < 50 days	-2.340	1.09	0.32	0.01- 0.81	0.68
Preceding C-section	4.186	1.38	65.75	4.38-986.7	0.11
S1-C > 32 days *	0.899	0.378	2.46	1.17- 5.18	0.26
Deviance = 165.571					
Likelihood ratio statistic on 6 df = 83.598, P < 0.001					

\* S1-C = interval 1st service - conception

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