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Higher odds of abortion in dairy cows hoof trimmed late in gestation

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ABSTRACT

Until now, it is unknown whether hoof trimming late in gestation is associated with increased risk of abortion in dairy cows. Using data from 1,476,013 pregnancies in Danish dairy cows, the objective of the present study was to evaluate risk factors for abortion in cows hoof trimmed during pregnancy. Odds of abortion was lower in first parity cows, lower in Jersey cows compared to other breeds, and higher in cows pregnant with twins. Odds of abortion was 2.4 times higher in cows hoof trimmed within the last four weeks before end of pregnancy. Hoof trimming of cows in late gestation should be done with caution.

Dairy farmers often have their cows hoof trimmed routinely to prevent hoof lesions and improve locomotion (Shearer and van Amstel, 2001). Several studies have shown that trimming may improve hoof conformation and, to some degree, prevent lameness and hoof lesions (e.g., Manske et al., 2002; van der Tol et al., 2004; Hernandez et al., 2007; Bryan et al., 2012). Optimal timing and frequency of hoof trimmings have received little scientific attention. Cows diagnosed with claw horn disruption lesions (sole ulcer and white line disease) at dry-off have been found to be more likely to die or be culled in the following lactation compared to cows without claw horn disruption lesions (Machado et al., 2010). Mahendran and Bell (2015) concluded that little evidence was available, but recommended prophylactic trimming around drying off. Recently, Thomsen et al. (2019) demonstrated that hoof trimming around drying off was associated with lower odds of sole ulcers in the following lactation. They recommended that cows should have their hooves trimmed around drying off, but, at the same time, raised the question whether handling of cows in late gestation in a hoof-trimming chute may be associated with higher risk of abortions. Studies have shown that handling of cows in a hoof-trimming chute is associated with stress indicated by increased levels of stress hormones (e.g. cortisol) and behavioural reactions (Pesenhofer et al., 2006; Rizk et al., 2012; Korkmaz et al., 2014; Janssen et al., 2016). Stress responses were typically more severe in lame cows and in cows trimmed in a walk-in trimming chute (possibly partly due to longer time needed to do the trimming) (Pesenhofer et al., 2006; Janssen et al., 2016). The vast majority of Danish dairy cows are trimmed in walk-in trimming chutes, and will have one or more legs lifted simultaneously from the ground during the trimming. During this, a number of straps under her thorax and abdomen suspends the cow. This procedure may result in a significant pressure on internal organs, including the uterus. The combination of stress and external pressure on the uterus may increase the risk of abortion in pregnant cows late in gestation. To our knowledge, this has not been evaluated scientifically until now. The objective of the present study was to evaluate hoof trimming late in gestation as a risk factor for abortion in dairy cows.

Information about all pregnancies in Danish dairy cows during the period 1st January 2012 to 31st December 2018 was retrieved from the Danish Cattle Database (DCD). The outcome of each pregnancy could be: 1) early foetal loss (during the first or second trimester), 2) abortion (defined as spontaneous expulsion of a dead foetus during the last trimester), or 3) calving (live or stillborn calf/calves born after a pregnancy of approximately normal length). Danish farmers are required to record the outcome of pregnancy in all cows and report it electronically to DCD. In more than half of all Danish dairy herds, the hoof trimmer records trimmings (and the presence of hoof lesions) for individual cows and transfers the data to DCD electronically. Pregnancies resulting in early foetal loss were excluded from the dataset, which then included 1,476,013 pregnancies, where the cow had been hoof trimmed at least once during the pregnancy, and where the hoof trimming date was reported to DCD. The dataset included information about the identity of the cow and herd, parity (1, 2, 3, 4, 5 or older), breed (Holstein, Jersey, Red Danish Dairy, crossbred), whether the pregnancy resulted in one or more calves (twins), hoof trimming date, as well as date and outcome of the pregnancy (abortion or calving). The time span between last hoof trimming and abortion or calving was grouped as '2 weeks or less' (1–14 days), '3–4 weeks' (15–28 days), '5–6 weeks' (29–42 days),

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Table 1
Descriptive statistics of explanatory variables included in an analysis to evaluate risk factors for abortion after hoof trimming in 1,476,013 pregnant Danish dairy cows.

Variable	Levels	Percent of pregnancies
Parity	1	15.0%
	2	35.8%
	3	24.6%
	4	14.0%
	5 or older	10.7%
Breed	Holstein	71.9%
	Jersey	13.1%
	Danish Red Dairy	6.2%
	Crossbred	8.9%
Twins	No	96.4%
	Yes	3.6%
Time span (trimming to end of pregnancy)	2 weeks or less	6.0%
	3–4 weeks	6.5%
	5–6 weeks	7.1%
	7–8 weeks	9.5%
	9 weeks or more	70.9%

Table 2
Results from a logistic regression evaluating risk factors for abortion after hoof trimming in Danish dairy cows.

Variable	Levels	Odds ratio	95% confidence interval of odds ratio	p-value
Parity	1	1[a]		< .0001
	2	2.49[b]	2.35–2.64	
	3	2.68[b]	2.52–2.84	
	4	2.77[b]	2.60–2.95	
	5 or older	2.80[b]	2.62–2.99	
Breed	Holstein	1[a]		< .0001
	Jersey	0.60[b]	0.57–0.64	
	Danish Red Dairy	0.94[a]	0.89–1.00	
	Crossbred	0.96[a]	0.91–1.12	
Twins	No	1[a]		< .0001
	Yes	1.23[b]	1.15–1.32	
Time span (trimming to end of pregnancy)	2 weeks or less	2.44[a]	2.32–2.56	< .0001
	3–4 weeks	2.38[a]	2.27–2.50	
	5–6 weeks	1.77[b]	1.69–1.87	
	7–8 weeks	1.14[c]	1.08–1.20	
	9 weeks or more	1[d]		

Odds ratios compare cows within each variable assuming all other variables being equal. Different superscript letters denote significantly different odds ratios within a variable.

'7–8 weeks' (43–56 days), or '9 weeks or more' (57 days or more).

Using a mixed effects logistic regression model (PROC GLIMMIX, SAS 9.3), we analyzed the association between the outcome abortion (yes or no) and the explanatory variables: parity, breed, twins, and time span. The interpretation of odds ratios from this analysis is based on all other explanatory variables being equal, e.g. effect of breed compares cows of different breeds but same parity, time span and status regarding twins. Herd was included as a random effect. Goodness-of-fit was evaluated by Pearson chi-square/degrees of freedom.

Overall, 1.24% (N = 18,331) of the 1,476,013 pregnancies ended by an abortion during the last trimester. Table 1 presents descriptive statistics of the explanatory variables. Approximately 29% of all cows were hoof trimmed during the last eight weeks before the pregnancy ended. Table 2 presents results from the logistic regression. Pearson chi-square/degrees of freedom was 1.02, indicating good overall fit of the model. Odds of abortion was lower in first parity cows, and Jersey cows had lower odds than cows of other breeds and crossbred cows. Pregnancies with two or more calves had higher odds of ending in an abortion compared to pregnancies with only one calf. Finally, odds of abortion was higher in cows hoof trimmed close to end of pregnancy. Odds of abortion was approximately 2.4 times higher in cows hoof trimmed within the last four weeks before end of pregnancy (3891 abortions of 184,232 pregnancies, 2.11%), compared to cows hoof trimmed more than eight weeks before end of pregnancy (11,058 abortions of 1,045,926 pregnancies, 1.06%). Odds of abortion in cows hoof trimmed five to eight weeks before end of pregnancy (3382 abortions of 245,855 pregnancies, 1.38%) was in between odds of cows hoof trimmed close to and long before end of pregnancy, respectively.

Reporting abortions to DCD is mandatory for Danish dairy farmers. The farmer must report an abortion within seven days (hereby minimizing recall bias), the reporting system includes a number of checks, and failure to comply with the requirement to report may result in a penalty. Therefore, the validity of the recordings of abortions is generally considered very high. Many other factors than handling in a hoof-trimming chute may cause abortions (Cabell, 2007). However, given the very large sample size in the present study, it is likely that such other risk factors are approximately evenly distributed between cows with different time span from hoof trimming to end of pregnancy. Even though the present study design cannot prove a causal relationship between hoof trimming and subsequent abortions, the results clearly suggest that caution should be taken when trimming cows in late gestation. Farmers and hoof trimmers should keep this in mind, and only trim cows in late gestation after an evaluation of the balance between risk of abortion and expected benefits of the trimming.

In conclusion, our results show that cows hoof trimmed late in gestation have significantly higher odds of abortion. Trimming of cows in late gestation should be done with caution. Handling should be as gentle as possible to reduce stress, and we recommend that only one leg should be lifted at a time to decrease external pressure on the uterus.

Declaration of Competing Interest

None of the authors of this paper has a financial or personal relationship with other people or organisations that could inappropriately influence or bias the content of the paper.

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