

THE IMPACT OF TWINNING AND STILLBIRTH ON REPRODUCTIVE AND ECONOMIC PERFORMANCE IN LARGE HUNGARIAN DAIRY HERDS

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The aim of our study was to quantify the effect of twinning and stillbirth on the main reproductive parameters, and to estimate the resulting economic loss on large-scale commercial dairy farms.

The data of 3.660 calvings that occurred on five large Hungarian Holstein-Friesian farms in 2016 and 2017 were analysed retrospectively. Information about twin calvings, stillbirths and uterine treatments were gathered. The main reproductive indices (i.e. calving to conception interval — CCI, services per conception — SPC, and first service conception risk — CRI) were calculated based on cow-level data. Statistical analyses were performed by using linear and logistic regression, and Dunnett-test. The economic losses related to twinning and stillbirth were estimated by partial budget analysis (1 EUR = 320 HUF).

Overall, twinning and stillbirth occurred in 4.1 % and 6.9 % of the calving events. Twinning was more likely, whereas stillbirth was less likely in multiparous cows (odds ratio [OR]: 4.18 and 0.64, $P < 0.0001$ and $P = 0.0015$, respectively). Following twin calving, CCI and SPC were increased by 12.8 days and by 2.8, respectively, whereas CRI was reduced by 7.1 percentage points. Twinning caused an estimated loss of 50.4 EUR/case. The analysed reproductive parameters were not impaired after stillbirth. Although, the reduction of calf number and the excess semen usage led to 112.5 EUR estimated loss per stillbirth case, on average.

Twinning and stillbirths are significant sources of economic loss on dairy farms, therefore, their prevalence should be reduced.

Keywords: DAIRY CATTLE, REPRODUCTION, TWINNING, STILLBIRTH, ECONOMICS

The events of the peripartal period require special attention in dairy cattle, since the majority of those animal health problems that may potentially reduce productive and economic performance occur during this period [7]. The prevalence of twin calving is approximately 10 %, on average, although it varies widely among dairy farms [6, 12]. Twin pregnancies increase the risk of pregnancy loss, dystocia, stillbirth, calf mortality, and culling of the dam, moreover, gestation length and birth weight of the calves are reduced. Freemartiniism occurs in 92–98 % of those twin pregnancies, when calves from both sexes are born [6, 8, 12].

Stillbirth is defined as the death of a calf just prior to, during, or within 24 to 48 h of parturition, following a normal gestation length [3, 10]. The prevalence of stillbirth ranges from 0.1 to 19.2 %, but on most farms it is between 6.5 and 9.3 % [1, 9, 10]. Stillbirth reduces milk produc-

tion mainly during early lactation, and increases the risk of culling of the cow, as well [2, 5].

The aim of our study was to survey the occurrence of twinning and stillbirths, and to quantify their effects on the reproductive and economic performance on Hungarian dairy farms.

Materials and methods

The study was conducted in five large commercial Hungarian dairy herds. In each herd, the number of cows exceeded 390, treatments were regularly recorded in the farm management software (RISKA, *Systo Kft.*, Budapest, Hungary), and shared the same reproductive advisor. Herd size, milk production and culling data of the studied herds are shown in table 1.

The protocol of reproductive examinations and treatments was identical on every studied

Table 1
Herd size, production and culling data of the surveyed herds (average of 2016 and 2017)

Herd	Number of cows	305-day milk yield, kg	Number of milkings per day	Annual culling rate, %
A	420	8,776	2	30.5
B	400	8,691	3	35.8
C	547	10,349	3	31.4
D	502	8,618	3	30.0
E	396	8,720	2	33.7

farm. Data were collected from the farm management software about the calvings that occurred in 2016–2017, as well as about the postpartum treatments and reproductive parameters. Those cows were considered affected with retained placenta, in which the fetal membranes were still present on the next day following calving. Uterine inflammation was diagnosed based on the evaluation of the discharge. The prevalence of twinning and stillbirth was quantified, furthermore, the main reproductive indices (calving to conception interval — CCI, first service conception risk — CR1, services per conception — SPC) were calculated, as well. The relationship of twinning and stillbirth with retained placenta, uterine inflammation, CCI, and CR1 were analysed. Statistical analyses were performed by using linear and logistic regression, and Dunnett-test. Data were analysed in *R version 3.4.2 (R Core Team, 2017)*.

In the partial budget model for the quantification of the economic losses caused by twinning and stillbirth, calf revenue, cost of open days and insemination cost were taken into account [11]. When calculating calf revenue, we assumed that calves are sold. According to Northern American studies, single and twin calvings yield 0.93 and 1.70 live calves, respectively, and twin calves weigh 15 % less compared to single calves, on average [4]. Stillbirth reduces calf revenue, and the insemination cost of producing the stillborn

calf is also incurred. Average prices and costs of the studied farms were used for the calculations; each extra open day was assumed to cost 2.5 EUR (1 EUR = 320 HUF). The economic analysis was performed in *Microsoft Excel 2016*.

Results and discussion

Altogether 3,660 calving events occurred in the studied period, of which 4.1 % was twin calving and 6.9 % was stillbirth (table 2). Twinning was more likely, whereas stillbirth was less likely in multiparous compared to primiparous cows.

The average CCI, CR1 and SPC were 139.8 days, 16.3 % and 5.74, respectively. The major reproductive parameters of the cows with twins or stillbirth by parity are shown in table 3. Following twin calving, a remarkable, although, nonsignificant decline was observed in the reproductive parameters. Following stillbirth, no marked decline in the reproductive indices was found.

The reproductive performance following twinning and stillbirth was compared to those cows, which gave birth to a single, live calf, and were free from postpartum uterine diseases (“healthy” cows, table 4). Despite the remarkably poorer reproductive performance in cows after twin calving, these differences remained not significant ($P > 0.05$). Fertility parameters declined after stillbirth, however, their differences compared to those of the “healthy” cows did not prove to be significant ($P > 0.05$).

The decline of the reproductive performance following twinning is probably attributable to the disorders of the uterine involution. However, we could not observe the negative effect of twin calving on the performance of the primiparous cows, which is most probably related to the low prevalence of twinning at first calving. The reproductive parameters did not significantly decline following stillbirth. This may be explained by these cows being subject to uterine treatments, which

The occurrence of twinning and stillbirth by parity (n=3,660)

Table 2

	n	Prevalence, %	Parity	n	Prevalence by parity, %	OR ^a	95 % CI ^b	P
Twinning	149	4.1	1	16	1.3	Reference		<0.0001
			≥2	133	5.5	4.18	2.5–7.45	
Stillbirth	251	6.9	1	113	9.0	Reference		0.0015
			≥2	138	5.7	0.64	0.48–0.84	

Note: ^a — odds ratio, ^b — 95 % confidence interval.

Table 3

The major reproductive parameters in case of twinning and stillbirth (n=3,660)

Parity	Twinning/Stillbirth	N	CCI ^a , days	Difference	SPC ^b	Difference	CR1 ^c , %	Difference
Primiparous	Single calf	1,233	141.6	Reference	5.3	Reference	18.6	Reference
	Twins	16	124.8	-16.7	4.2	-1.1	9.1	-9.5
Multiparous	Single calf	2,278	138.0	Reference	5.9	Reference	15.4	Reference
	Twins	133	156.9	18.9	9.2	3.3	9.6	-5.9
<i>Altogether</i>	<i>Single calf</i>	<i>3,511</i>	<i>139.4</i>	<i>Reference</i>	<i>5.7</i>	<i>Reference</i>	<i>16.6</i>	<i>Reference</i>
	<i>Twins</i>	<i>149</i>	<i>152.2</i>	<i>12.8</i>	<i>8.5</i>	<i>2.8</i>	<i>9.5</i>	<i>-7.1</i>
Primiparous	Live calf	1,136	141.9	Reference	5.1	Reference	19.1	Reference
	Stillbirth	113	134.8	-7.1	6.9	1.8	11.8	-7.2
Multiparous	Live calf	2,273	139.4	Reference	6.1	Reference	14.9	Reference
	Stillbirth	138	124.9	-14.5	5.1	-1.0	18.7	3.8
<i>Altogether</i>	<i>Live calf</i>	<i>3,409</i>	<i>140.4</i>	<i>Reference</i>	<i>5.7</i>	<i>Reference</i>	<i>16.4</i>	<i>Reference</i>
	<i>Stillbirth</i>	<i>251</i>	<i>129.7</i>	<i>-10.7</i>	<i>6.0</i>	<i>0.3</i>	<i>15.4</i>	<i>-1.0</i>

Note: in this and the next table ^a — calving to conception interval, ^b — services per conception, ^c — first service conception risk.

Table 4

The major reproductive parameters of cows with twins and stillbirth compared to “healthy” cows (i.e. cows that gave birth to one live calf and were free from postpartum uterine diseases) (n=3,660)

	n	CCI ^a , days	Difference	SPC ^b	Difference	CR1 ^c , %	Difference
“Healthy”	2,008	130.4	Reference	4.9	Reference	18.7	Reference
Twinning	149	152.2	+21.8	8.5	+3.6	9.5	-9.2
Stillbirth	251	129.7	-0.7	6.0	+1.1	15.4	-3.3

was often not performed in cows that gave birth to live calves, although fertility could also be negatively affected in these animals if a subclinical uterine disease was present.

The prevalence of retained placenta and uterine inflammation was 13.3 and 29.4 %, respectively. The risk of retained placenta was increased by twinning (OR=2.22, P<0.0001) and stillbirth (OR=1.23, P<0.0001), as well. The risk of uterine inflammation was not related to stillbirth (OR=1.05, P=0.1364), although it was reduced after twinning (OR=0.76, P<0.0001).

The results of the economic analysis are shown in table 5. The number of extra calves could not compensate for the extra cost of open days and inseminations following twin calving.

Table 5

Economic analysis of twinning and stillbirth, EUR

Cost factor	Twin calving	Stillbirth
Calf revenue	+25.3	-64.2
Open days	-32.0	+26.8
Insemination	-43.8	-75.0
<i>Altogether</i>	<i>-50.4</i>	<i>-112.5</i>

Note: Positive numbers indicate economic gains, negative numbers indicate economic losses.

The economic loss due to stillbirth exceeded the cost of twinning.

Conclusions

Based on our results, twinning was more common, whereas stillbirth was less common in multiparous compared to primiparous cows. Stillbirth caused larger losses than twinning, mainly due to the foregone calf revenue, and the cost of semen used to produce the stillborn calf. The risk of retained placenta was increased by twinning and stillbirth, as well. Both twinning and stillbirth should be considered significant sources of economic loss in large dairy herds.

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