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Study of Perinatal Mortality and Dystocia in Dairy Cows in Fars Province, Southern Iran

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Abstract: To determine the perinatal calf mortality in the region and to study some of contributing factors, a retrospective survey was conducted in the Fars province, southern Iran. Using monthly report of 64 registered dairy herds, data about births since September 2003 to December 2004 was obtained from the Agricultural Jihad Organization of the province including parity of dam, dystocia, sex of calves, and it's survival up to one hour of birth. Dystocia was recorded as birth without assistance, with one assistant, with two assistants and with jack. Mortality rate was calculated as proportion of died calves to all births. According to number of dairy cows, study herds were categorized as less than 50 heads, 50-100 heads and more than 100 heads. Statistical analysis was done by Chi-square test, Fisher's exact test and logistic regression. The mortality rate was 3.5%. There was no significant association between parity of dam, sex of calf and season of calving with mortality. Overall dystocia rate was 9.8% with significantly highest level in heifers ($p<0.001$). There was strong association between degree of dystocia and mortality rate. Odds of death was 4 times in calving with one assistant (OR = 4.26, 95% CI: 1.5-11.4) and 44 times (OR = 44.5, 95% CI: 14.5-136.1) in pull with jack compared to calving without assistance. In difficult calving, there was significant trend for mortality to increase with parity ($p = 0.008$). Herd size had no effect on calf mortality however larger herds had significantly higher level of dystocia ($p<0.001$). According to this study, difficult calving is the most important factor affecting the calf mortality. Also, heifers are at greatest risk due to high level of dystocia. However, when calving is difficult, multiparous dams have more risk for calf death compared with heifers.

Key words: Calf mortality, dairy cows, dystocia, parity

Introduction

Perinatal mortality and calving difficulty (dystocia) have caused important economic losses to dairy producers. Rates of perinatal calf mortality have usually been 3 to 10% for most breeds of cattle studied (Berger *et al*., 1992; Berglund *et al*., 2003; Erf *et al*., 1990; Martinez *et al*., 1983; Meyer *et al*., 2001). Perinatal calf mortality may be roughly divided into mortality associated with dystocia and mortality occurring in deliveries considered normal (Berger *et al*., 1992). Season of birth, sex and weight of calf, twinning and parity of dam have been associated with calf mortality in earlier studies (Berger *et al*., 1992; Berglund *et al*., 2003; Erf *et al*., 1990; Martinez *et al*., 1983; Meyer *et al*., 2001). From epidemiologic perspective, description of the problem and identification of factors which can alter a calf's risk of death is an important prerequisite for avoiding excessive calf mortality in each region. The objective of this study was to determine rate of calf mortality and dystocia in Fars province (Southern Iran) dairy herds and the relationship between them with season of birth, parity of dam, sex of calf and herd size.

Materials and Methods

This is a retrospective survey which conducted in Fars province in southern Iran. As a part of ongoing surveillance system, data about milk production and calving information of registered dairy herds are routinely compiled by the Agricultural Jihad Organization (AJO) of the province on a monthly basis. Data are recorded by the farm staff on a prepared data sheet. Validity and reliability of records are checked regularly by AJO responsible personnel. The total number of births for a period from September 2003 to December 2004 was obtained from AJO using the monthly reports of 64 dairy herds. They have different management practices; however all of them were crossbred or Holsteins and non-seasonally calving dairy herds which were artificially inseminated as a routine. Parity of dam, dystocia, sex of calves, and it's survival up to one hour after birth, number of calves in parturition (single vs. twin), herd size and season of breeding were recorded. Dystocia was categorized as birth without assistance, with one assistant, with two assistants and with jack. Mortality rate was calculated as proportion of died calves to all births.

Herds were grouped according to the number of dairy cows to small (below 50), medium (50-100) and large (above 100) ones. There were 51 small herds, 10 medium sized herds, and 3 large herds accordingly.

Due to the small number of cows in high parity groups, birth order (parity) was categorized to first, second, third, fourth and fifth or greater.

During the study period 2831 births were recorded in 64 dairy herds in the region, which 2748 cases were single births. Due to absence of calf survival data for 36 cases, finally 2712 births included for mortality study.

All analyses were done by SPSS software (version.11.5). Because calf mortality (alive or dead) is a binary trait, we chose to use logistic regression to model calf mortality. Factors with $p <= 0.3$ in Fisher's exact tests and Chi-square tests were included in the regression model, including sex of calf, parity of dam and degree of dystocia. The analysis procedure automatically drops records with missing values when these values are needed for the analysis.

Results

Incidence of calf mortality up to 1 h of birth was 3.5%, ranging from 0 to 9% in different herds. Stillbirth was responsible for 63% of all deaths. Rates of calf mortality by parity of dam are shown in Table 1. Mortality was greater for primiparous cows (4.3%) than all other parities, but the difference was not significant ($\chi^2 = 2.5$, df = 1, $p = 0.1$).

Deaths by sex of calf and season of birth are shown in Table 2. Mortality for male and female calves were 3.3 and 2.6% respectively ($p = 0.24$). Calf mortality was highest in winter (4.2%) and lowest in summer months (2.8%) which this difference was not significant.

Most of births (91.2%) required no assistance, while 9.8% required assistance of some sort (Table 3). Primiparous dams experienced significantly more dystocia than multiparous dams ($p<0.001$). Although 10.1% of male calves were born by some assistance in comparison with 8.2% of female calves, sex of calf was not a significant factor in dystocia ($\chi^2 = 2.71$, df = 1, $p = 0.09$).

Table 1: Calf mortality rates according to parity of dam in 64 dairy herds in Fars province, Iran

	Parity of dam*				
	First	Second	Third	Fourth	Fifth or greater
Number of death	35	18	12	11	16
Number of alive	780	642	428	314	420
Mortality rate (%)	4.3	2.7	2.7	3.4	3.7

*Missing data: 36 cases

Mortality rates for calving without assistance, with one assistant, with two assistants and with jack were 1.5, 9.1, 30.1 and 58.8% respectively. There was significant association between calf mortality and degree of dystocia (Fisher's exact test, $p<0.001$).

Overall 58.7% of deaths were associated with dystocia. Mortality rates by degree of dystocia and parity of dam are appeared in Table 4. As it is clear, for non-assisted calving category, there is no significant difference in calf mortality between primiparous and multiparous cows ($p = 0.23$). However, with difficult calving, there is significant trend for calf death to increase with parity of dam ($p = 0.008$).

There was no significant association between calf mortality and herd size; however larger herds had significantly more assisted calving than other herds (Table 5).

Results of logistic regression model for calf mortality are shown in Table 6. Parity of dam and sex of calf were not significant factors in this model, while degree of dystocia influenced mortality. Odds of death was 4 times (OR = 4.26, 95% CI: 1.5-11.4) higher in calving with one assistant and 44 times (OR = 44.5, 95% CI: 14.5-136.1) higher in pulling with jack compared to calving without assistance.

Table 2: Calf mortality rates according to sex of calf and season of birth in 64 dairy herds in Fars province, Iran

	Number of death	Number of alive	Mortality rate (%)
Season*			
Spring	16	563	2.8
Summer	31	761	3.9
Autumn	25	792	3.1
Winter	22	501	4.2
Sex**			
Male	33	1229	2.6
Female	47	1382	3.3

*($\chi^2 = 2.58$, df = 3, p = 0.46), missing data: 1 case, **($\chi^2 = 1.32$, df =1, p = 0.24), missing data: 21 case

Table 3: Relative frequency distribution of births according to degree of dystocia and parity of dam in 64 dairy herds in Fars province, Iran

	Degree of dystocia			
Parity	1	2	3	4
1	82.0	10.8	5.2	1.9
2	92.9	5.3	1.1	0.8
3	95.2	3.4	0.5	0.9
4	94.2	3.1	1.5	1.2
>= 5	92.6	3.4	1.4	2.5

Note: Degree of dystocia: 1 without assistance, 2 with one assistant, 3 with two assistants and 4 with jack

Table 4: Calf mortality rates according to parity of dam and dystocia in 64 dairy herds in Fars province, Iran

	Parity of dam				
Dystocia	First	Second	Third	Fourth	Fifth or greater
No*	2.1	1.6	1.2	1.3	1.0
Yes**	11.7	15.8	31.6	28.6	29.2

*($\chi^2 = 1.52$, df = 1, p = 0.23), ** ($\chi^2 = 7.08$, df = 1, p = 0.008)

Table 5: Calf mortality and dystocia rates according to herd size in 64 dairy herds in Fars province, Iran

	Herd size		
	< 50	50 - 100	> 100
Number of death	38	29	27
Number of alive	1076	820	722
Mortality rate* (%)	3.4	3.4	3.6
Dystocia present	69	90	109
Dystocia absent	1044	757	643
Dystocia rate** (%)	6.2	10.6	14.5

*($\chi^2 = 0.06$, df = 1, p = 0.97), **($\chi^2 = 35.3$, df = 1, p = 0.001)

Table 6: Results of logistic regression model for calf mortality in 64 dairy herds in Fars province, Iran

Independent variables	OR	SE	95% CI	p-value
Parity of dam*	1.12	0.39	0.51-2.4	0.76
Sex of calf**	1.08	0.36	0.53-2.2	0.82
Degree of dystocia***				
With one assistance	4.26	0.51	1.5-11.4	0.005
With two assistance	11.6	0.57	3.7-35.5	0.001
With jack	44.5	0.57	14.5-136.1	0.001

Basis for comparison: *First parity, **Female calves, ***Calving without assistance

Discussion

In present study incidence of calf mortality up to 1 h of birth was 3.5%. There are multiple definitions for perinatal calf mortality (Radostites, 2001), however, in most reports mortality within 24 h of birth was recorded (Berger *et al*., 1992; Berglund *et al*., 2003; Erf *et al*., 1990; Martinez *et al*., 1983; Meyer *et al*., 2001). Therefore somewhat lower mortality in present study is plausible. It is advisable to change the routine recording and reporting schedule so that more comprehensive rates could be calculated.

Higher mortality rate in primiparous cows than multiparous cows has indicated in some studies (Erf *et al*., 1990; Johanson and Berger, 2003; Martinez *et al*., 1983; Meyer *et al*., 2001; Nix *et al*., 1998). In present study, however, there was no significant difference between primiparous and multiparous dams for calf mortality. We chose the logistic regression model for statistical analysis. This procedure estimates the effect of one variable while assuming that the other variables are constant. There is a possibility that difference of mortality between primiparous and multiparous dams is substantially due to higher dystocia rates in the former. When dystocia included in the regression model, the parity no more be significant. The strong association between dystocia and parity of dam, on one hand, and the powerful influence of dystocia on mortality, on the other hand, support this hypothesis. It should be mentioned that nearly all studies on calf mortality consistently showed that primiparous dams have the greatest rate of dystocia (Johanson and Berger, 2003; Nix *et al*., 1998; Wittum *et al*., 1993) and that risk of calf death in difficult calving is much higher than normal delivery (Azzam *et al*., 1993; Berglund *et al*., 2003; Johanson and Berger, 2003; Mc Dermot *et al*., 1992; Meyer *et al*., 2001; Wittum *et al*., 1993).

In this context it is important to emphasize that according to result of present study, the effect of dystocia on calf mortality is greater for multiparous cows when compared to primiparous dams. From previous studies just Meyer *et al*. (2001) noticed this point. Most cases of dystocia in first lactation cows result from incompatibility between size of calf and pelvic opening of the dam due to physical immaturity (Nix *et al*., 1998). In multiparous cows, however, contribution of other factors such as hypocalcemia should be considered (Curtis *et al*., 1983). This etiologic difference in dystocia may be a possible reason for differential effect of dystocia on calf mortality.

The overall dystocia rate in current study was 9.8%. This rate is reported to be between 6 to 60% in other studies (Nix *et al*., 1998). This variability may be attributed to variation in genetic makeup and type of sperm used (Berglund *et al*., 2003; Nix *et al*., 1998). Currently sperm selection for dystocia is performed in few herds in the regions. More expanding use of such selection programs potentially could ameliorate the problem. This variability also may be due to variations in management. Factors such as number of employees available and relative experience of employees may have affected observation schedule for pregnant dams as well as decisions to assist at birth. This seems to be plausible reason that why dystocia was significantly higher in larger herds.

In contrast with some studies (Berglund *et al*., 2003; Nix *et al*., 1998; Rao and Nagarcenkar, 1980) according to our study, sex of calf was significant factor neither on mortality nor on dystocia. Some studies indicated that observed relationship between sex of calf with mortality and dystocia is due to

confounding effect of weight, which is generally higher in male calves than females (Johanson and Berger, 2003; Mc Dermot *et al*., 1992). Unfortunately in this study data about weight of calves was not available. It is recommended to do further studies and take into account the weight of calves in the analysis.

In conclusion, although overall calf mortality in dairy herds in Fars province is not generally high, those herds with mortality level as high as 9% need special attention. Future investigation on these herds to define the possible contributing factors is highly recommended. In this study and in agreement with previous studies, difficult calving is the most important factor affecting the calf mortality. Heifers are at greatest risk of calf death due to high level of dystocia. However; when calving is difficult, multiparous dams have more risk for calf mortality compared with heifers. The results of this work could be used for planning and implementing of preventive measures and as a basis for future comparison and evaluating studies in the region.

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