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Twinning in Iranian Holstein Dairy Cattle: A Study of Risk Factors and Production and Reproduction Consequences

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Introduction Cattle are a monotocous species meaning that, under most circumstances, a successful pregnancy results in the birth of one calf. Twinning rate has been reported in dairy cows from 3 to 5 percent, which can be influenced by maternal age.The birth of twins is detrimental to the majority of beef and dairy cattle producer. Financial loss arising from any of twinning has been reported in Europe between 109 to 201 dollars in recent years. Because it is associated with undesirable consequences such as reduced survival, calf, cow increased removal rate and poor performance. This also reduces pregnancy rates and profitability herds. One of the effects of twinning severe is reduction of the number of calves for replacement fertility in dairy cows. This is a loss arising from an increase in infant mortality and a gender bias in bull calves homo zygote.Twinning rate increases significantly the incidence of reproductive abnormalities, including the retained placenta, dystocia, stillbirth and abortion. Many studies have been done on the effect of multiple pregnancies in cattle production and reproduction. Higher milk production for cows twin issue is controversial as some studies have shown that there is a positive correlation between the rate of twinning in dairy cattle and milk production. But in the next lactation, production for cows that have been the twin of the infected cow metabolic disease in the previous period was lower. In a study reported that cows spend fewer days in the twin peak production. The results of the study on the effect of twinning on reproductive traits of Holstein cows-Farzin showed that only half of the twin cows are prone to reproduce in the next period. It is also reported a greater number of insemination per conception in twin compared to single cows. In addition, it has been reported that the twin was more than 15 days from calving to first services. Average twin cows experiencing 1.7 times more death and removal in lifetime production than cows single.The aim of this study was to estimate the rate of twinning in Iranian Holstein dairy cows and the estimated effect on production traits and reproductive twinning.

Material and method Data from 9 Holstein dairy herds from 2 regions, Khorasan Resavie and Isfahan, in Iran during the period 2001 to 2013 were used. Editing of initial data set was done with Excel. Duplicate observations, missing data for calf condition and cows with age at first calving < 19 or > 45 month were excluded. Following all edits, 160,410 calving records of 52,562 cows were utilized.

According to binary nature of twinning, a logistical regression model was constructed to estimate the effect of bio-environmental risk factors on twinning using the LOGISTIC procedure of SAS the used model was as follows:

$$\text{Logit}(\pi) = \alpha + \beta 1X1 + \beta 2X2 + \ldots + \beta nXn \qquad (1)$$

A linear mixed model was used to analyze twinning effect on productive and reproductive traits using Proc Mixed of SAS Software. In this model fixed effects were included herd effect, calving season (calving year, parity, twinning, stillbirth and dystocia. The effect of other factors were considered as random. The mixed linear model used for this analysis included:

$$Y_{ijklmnopqrs} = \mu + Herd_i + Parity_j + Cyear_k + Season_l + b_{1m}(DIM_{ijm} - \overline{DIM}) + b_{2n}(AFC_{ijn} - \overline{AFC}) + b_{3o}(Preg_{ijo} - \overline{Preg}) + TWN_p + STB_q + DYS_r + Sex_s + Cow_t + e_{ijklmnopqrs} \qquad (2)$$

Results and discussion The incidence of twinning cases per cow per year was 2.7 %, on average. Herd,

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calving year, calving season and parity had a significant relationship with the incidence of twinning (P<0.001). Primiparous (0.4%) and fourth parity (4.47%), winter (2.2%) and summer (3.1%) were lowest and highest incidence respectively. Increased age of first calving showed a tendency to increase incidence of twinning (P=0.1). Twinning had no significant effects on 305-d milk, fat and protein percentages (P ≥0.1). Twinning increased open days by 24.8 and 12.8 d and insemination per conception by 0.04 and 0.18 unit in primiparous and multiparous cows, respectively (P<0.001). The negative reproductive effects of twining were more severe for primiparous than multiparous cows.

Conclusion Twinning statistically showed a positive phenotypic trend in the study population. Twinning had no effect on productivity (milk, fat and protein percentages) cows while was reducing reproductive efficiency (increased number of insemination per conception and open days). Twinning increased sharply risk of dystocia and stillbirth, especially in the case of both sexes were male calves, Reproductive consequences were more severe for primiparous cows than multiparous cows. Given the strong correlation between the rate of twinning and environmental factors such as herd, year, season and parity, be carried out in each herd management program according to the time and circumstances.

Keywords: Dairy cattle, Odds ratio, Production and Reproductive performance.