Embryonic losses between the early diagnosis and the confirmation of gestation in dairy cows from different farms for one year

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ABSTRACT

Objective: To determine embryonic losses between the early diagnosis and the confirmation of gestation in dairy cows from different farms for one year.

Design/Methodology/Approach: A total of 3,413 confined Holstein cows from three different dairy farms in the Mexican Altiplano (highlands) were studied. Cows were milked three times a day with an average daily production of 36.5±1.5 L. Gestation diagnosis was performed by ultrasonography at 34±7 d after the artificial insemination, while gestation was confirmed at 60±5 d. Average pregnancy loss was determined and embryonic losses were compared taking into account farm and month.

Results: The overall average of embryonic losses was 18.8%. Neither the month factor nor the month×farm interaction affected the percentage of embryonic losses ($p<0.05$). Differences per farm ($p<0.05$) were observed and farms 1, 2, and 3 recorded losses percentages of 4±1.6%, 11.4±1.6%, and 22.9±1.6%, respectively.

Study Limitations/Implications: Detailed differences between farms were not studied, since cow management was similar in all three of them. Embryonic losses must be recorded, given their significant impact on the farm.

Findings/Conclusions: There is a high variability among farms regarding embryonic losses between the early diagnosis and the confirmation of gestation. This situation may be the result of management differences, since the breed and environmental conditions were the same in all three farms.

Keywords: embryonic losses, Mexican Altiplano, dairy cattle.

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INTRODUCTION

In recent years, specialized dairy cattle have shown higher milk yields as a result of intensive genetic selection and recent genomic evaluation of young bulls (Rearte *et al.*, 2018). However, intensive genetic selection is expensive and the reproductive efficiency of high-yielding dairy cows has decreased worldwide, mainly in the first services (Lucy, 2019). There is great concern about the increase and economic impact of late embryonic mortality (Quintero *et al.*, 2019) and fetal losses in cows (Abdalla *et al.*, 2017). Pregnancy loss in specialized dairy cattle is severe: losses up to 50 and 60% of pregnancies were observed from fertilization to calving in some studies and only one out of two gestations was successful (López-Gatius, 2012; Santos *et al.*, 2004).

In 2016, Diskin *et al.* (2016) documented an increase in embryonic losses of Holstein cows from 28% to 43% during the 1980s.

Likewise, Lucy (2019) proved that fertility rates are no longer dropping in some countries and the fertility decline was interrupted. Embryonic losses have an important economic impact on the production system. Most of the reports about the cost of pregnancy loss come from the United States. However, Albuja *et al.* (2019) developed the first report for Mexico, valued in Mexican pesos. They pointed out that a pregnancy loss in the first, second, and third quarters can cost $5,440.00 MXN ($272.00 USD), $10,000 MXN ($500.00 USD), and $ 22,800.00 MXN ($1,140.00 USD), respectively. These figures are important, since business profitability could be affected by the high percentage of pregnancy losses. The objective of the study was to establish yearly embryonic losses between the early diagnosis and the confirmation of gestation by ultrasonography in specialized dairy cows that had been confined in different farms from the Mexican Altiplano.

MATERIALS AND METHODS

The study was conducted from January 1st to December 31st, 2018 in a geographic region with the following characteristics: 2,230 m above mean sea level, a semi-arid and temperate climate, an average annual temperature of 16.8 °C, and a relative humidity of 40%. Cows were managed in intensive production systems and had free access to shade, individual stalls, clear water, white salt, sodium bicarbonate, and a complete ration. Cows were milked 3 times a day, recording an average daily production of 36.5±1.5 L.

The three farms had similar management. However, in broad terms there were differences among them, including: cow flow in pens, overcrowding in pens, peripartum care, difference in ration inputs, and vaccination programs.

All cows were fed a high-forage diet (60%) and 16% CP from three weeks prior to calving up to 14 days after parturition, followed by a transition diet consisting of 53% forages and 18% CP. One week later, they were moved to production pens, where they received a diet of 47% forages and 16% CP. The ration was composed mainly of alfalfa hay, corn silage, rolled corn, soybean meal, cotton seed, wheat straw, distillers' dried grain with soluble (DDGS), molasses, vitamins, and minerals.

Reproductive management was similar among farms which had a voluntary waiting period of 65±5 d. Once a week, cows were incorporated into a pre-synchronization program (Moreira *et al.*, 2001) with two prostaglandin $PGF_2\alpha$α injections (12 to 14 d between applications). Seven days after the last $PGF_2\alpha$αinjection, they were incorporated into an OvSynch program (Pursley *et al.*, 1995). Gonadorelin acetate (300 μg per cow) was used as a source of GnRH and dinoprost tromethamine (25 mg per cow) was used as prostaglandin $PGF_2\alpha$.

Cows showing estrus (18-24 d post-insemination) were inseminated again. Gestation was diagnosed by ultrasonography (Easi-Scan, BCF technology, Universal Goggles, Scotland) at 34±7 d after insemination. Pregnancy was detected through the amniotic vesicle and the presence of a viable embryo (confirmed by a heartbeat). Pregnancy diagnoses were confirmed by ultrasonography (gestation of 60±7 d). The percentage of embryonic losses was calculated dividing the number of non-pregnant cows at 60 d by the number of pregnant cows at 34 d.

The DairyComp 305 software (2018) was used to store information about the 3,413 initial gestations. Chi-square was used to compare pregnancy losses per month and per ranch. The statistical analysis was performed using the STATISTICA 7 software (StatSoft, Hamburg, Germany).

RESULTS AND DISCUSSION

The month did not affect ($p \geq 0.05$) the percentage of embryonic losses, which were very similar throughout the year, despite the monthly variability (13.1-38.4±9.6) (Figure 1).

These results are different from those of other works in which heat stress is reported to increase embryonic losses by 10 to 50% (Dash *et al.*, 2016; Wiltbank *et al.*, 2016). Heat stress has an extremely significant effect on embryonic losses in dairy cows. Temperature and relative humidity were lower (18±6 °C and 40±5 %) in this study than those reported by other authors; therefore, temperature and humidity index are higher (Dash *et al.*, 2016) and may have made the difference between studies.

The month×farm interaction ($p \leq 0.05$) impacted embryonic losses. There was a higher percentage of embryonic losses in farm 3 during the months of April, November, and December than in farms 1 and 2 (Figure 2).

Embryonic losses in this study amounted to 18.8% and there were 4.1 to 22.9% differences among farms. Other researchers (Dash *et al.*, 2016; Lonergan *et al.*, 2016; Quintero Rodríguez *et al.*, 2019) reported similar results, with 3.2% to 42.75% differences in embryonic loss and a 12.5% average (6.3% lower than in this study). Despite having a high average, the results of this study have a similar range to those recorded in other studies (Ferreira *et al.*, 2016; Rani *et al.*, 2018).

The average embryonic loss was 18.8%. There was also a farm effect ($p \leq 0.05$): farm 1 had the lowest percentages of late embryonic losses, followed by farm 2, while farm 3 had the

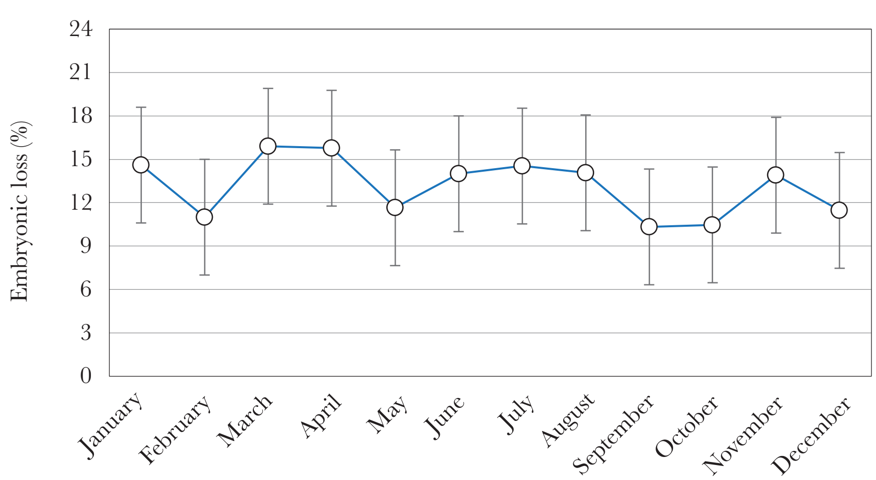

Figure 1. Embryonic losses between the early diagnosis and the confirmation of gestation in specialized non-affected dairy cattle confined in farms ($P \geq 0.05$) per month (2018).

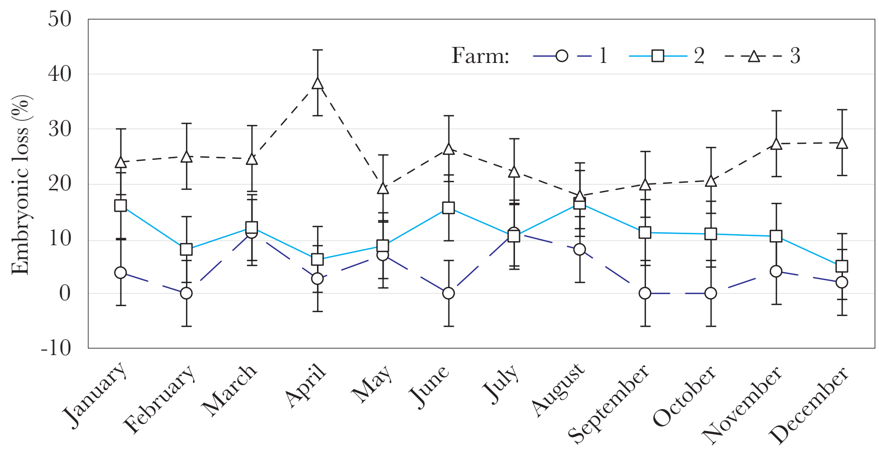

Figure 2. Embryonic losses between the early diagnosis and the confirmation of gestation in specialized and affected dairy cattle ($p \leq 0.05$) per month×farm (2018).

highest percentages (Figure 3). This study and many others confirm that embryonic losses in high-yielding dairy cattle from different regions of the world have similar percentages; therefore, it is advisable to research possible solutions to this major problem.

These results may be caused by to the impairment of the reproductive tract ability of lactating cows at 60 d postpartum to maintain a developing embryo observed by Maillo *et al.* (2012). This phenomenon may contribute to early embryonic deaths. The body condition of cows at drying (prepartum, 30 and 60 days postpartum) was not considered as a variable that determined the possible loss of body condition. This decision could explain the high number of embryonic losses. For their part, Middleton *et al.* (2019) reported that cows with body condition losses in early lactation (first 30 d in milk) are more likely to suffer pregnancy loss, which implies a greater risk that the cows could not get pregnant before 130 d in milk.

Recently, Fricke *et al.* (2022) reported that the fertility or pregnancy problems among high-yielding dairy cows has been solved through the use of various reproductive hormones

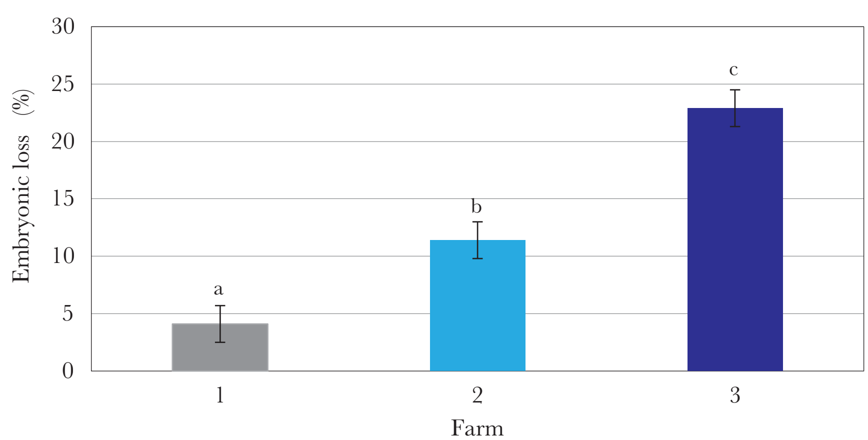

Figure 3. Farm effect on embryonic losses between the early diagnosis and the confirmation of gestation in dairy cows from the Mexican Altiplano (bars with different letters differ: $p < 0.05$).

in different fixed-time artificial insemination protocols. Nevertheless, the current problem is not getting cows pregnant, but preserving gestations. Fricke *et al.* (2022) also emphasized that the loss or gain of body condition peripartum has a great impact, not only on fertility in the first services, but also on the loss or maintenance of gestation.

In the meta-analysis carried out by Reese *et al.* (2020) —which included studies from 1978 to 2017—, gestations were diagnosed from day 29 to day 60, along with 30,500 pregnancies and 5.8% of late embryonic losses (13% below the results of this study).

Rather than trying to explain the multiple causes of the potential differences among the farms with a variable embryonic loss, the point is to approach these results with a practical focus and assess the economic losses, since pregnancy loss can have a major impact on the economic performance of dairy farms (Bekara and Bareille, 2019). Albuja *et al.* (2019) estimated that a pregnancy loss in the same region as this study had a cost of $5,449.00 MXN ($272.45 USD) during the first quarter. The increase from 12.5% (1997-2016 reports) to 18.8% (this study) represent 214.9 more embryonic losses in the latter group, which entails an economic loss of $1,171,184.00 MXN ($58,559.20 USD) in the observed farms.

CONCLUSIONS

Embryonic losses between the diagnosis and the confirmation of gestation were 19% on average, regardless of the month of gestation. There were differences in percentages of embryonic losses among the farms, which may have been the result of the management of each facility. High percentages imply high costs that impact the profitability of the production units. According to the results of this research, serious consideration should be given to the collection and analysis of pregnancy losses data from the first early diagnosis to the confirmation of pregnancy. The ultimate purpose would be to make appropriate decisions and consequently to reduce any losses, since the figures reported in our country imply considerable economic losses.

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