NATIONAL AGRICULTURAL AND FOOD CENTRE
RESEARCH INSTITUTE FOR ANIMAL PRODUCTION NITRA

Slovak J. Anim. Sci., 53, 2020 (3): 104–109

ISSN 1337-9984
E-ISSN 1338-0095

A HERD-LEVEL STUDY OF REPRODUCTION PROCESS AND POST-PREGNANCY PROBLEMS OF HOLSTEIN DAIRY CATTLE IN IRAN

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ABSTRACT

The main purpose of this study was to investigate some critical factors affecting the reproduction process and causing the post-pregnancy problems in Holstein dairy cattle herd. One of the critical factors of concerns for herd managers in industrial dairy farms is timed calving, which can result in a greater profit. To achieve this, timed insemination should be done and the post-partum diseases should be controlled as much as possible so that the subsequent pregnancy would not be delayed. Therefore, this study evaluated the reproduction process in one of the largest industrial dairy farms in Yazd province, Iran. A group of 373 cows was monitored since 2005 to 2014. The obtained results indicated that out of the total number of calving, natural calving had the highest number while the dystocia had the lowest. The rate of post-pregnancy problems was raised by the birth of male calves. It was also observed that as the numbers of parity increased, the rate of natural calving increased considerably, whereas the rate of uterine infection decreased. Nevertheless, the ovarian cyst incidence was increased slightly up to the third parity, while it was decreased after the third calving.

Key words: reproduction; pregnancy problems; Holstein cows

INTRODUCTION

One of the most important reasons of losses of dairy cows in Iran is the reproductive problems. Inadequate reproductive performance of dairy cows, one of the factors of reducing both milk production and calving over the year, can occur in the form of either calving intervals or forced removal of dairy cows, or both of them (Ferguson, 2005; Sewalem *et al.*, 2008). One of the purposes of dairy cow breeding is to enhance the yield and economic productivity using most breeding programs based on milk yield traits (McAllister *et al.*, 1990). However, it is not always a cost-effective issue to increase milk production because it can cause some factors such as prolonging the calving intervals, extending the number of non-pregnancy days and the age of calving, which are not economically viable and efficient (Hansen, 2000). Although in the first and second calving, a strict selection to increase milk production may not directly decrease survival but due to increased diseases, reproductive disorders and other factors, involuntary elimination is increased noticeably based on which longevity in calving and the age of the herd are reduced (Hansen, 2000).

Generally, to obtain higher milk production, we should design an appropriate reproductive program (Plate-Church, 2002). As such, some productive (e.g. milk production) and reproductive traits are in a positive correlation (Veerkamp, 1998). Thus, the selection of bulls for milk production will not have a significant impact on the reproductive performance

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Received: January 14, 2020
Accepted: July 1, 2020

of dairy cows (Brotherstone *et al.*, 2002; Wall *et al.*, 2003). Nevertheless, proper management can prevent reproductive decline, which is in negative relationship with productive traits. Here, it is worthwhile to mention that the interval between calving and pregnancy (open days) mainly depends on some important factors, such as an artificial insemination technique, calving season, herd management, herd size, production level and the number of parity (calving) (Oseni *et al.*, 2003). In high-performance dairy herds, the attempts to raise the performance may cause a negative impact on fertility (Gröhn & Rajala-Schultz, 2000).

The reproductive efficiency of a cow is usually determined by the age of first calving, the number of non-pregnant days, the number of inseminations per pregnancy and the interval between two calvings (Dematawewa & Berger, 1998). According to the mentioned factors, the aim of this study was to investigate some critical factors affecting both the reproduction and pregnancy of dairy cows.

MATERIAL AND METHODS

Dairy herd information

The study was conducted in the Yazd province (Latitude 31° N' and Longitude 54° E), having an average temperature of 30 ± 2 °C, in an industrial dairy farm (1000 cow) with the mean milk production of 32 kg.d^{-1} being fed three times a day with TMR. The cows were artificially inseminated (1.6 ± 0.1 service per cow).

Data collection

The reproductive traits of 373 dairy cows were monitored in this investigation. All data were collected for ten years (from 2005 to 2014). In addition, cows from the first to the fifth parity were used. The following criteria were observed:

- The sex of born calves
- Dystocia
- Ovarian cysts caused by the birth of male or female calves (Ovarian cysts were determined by a veterinary expert using rectal palpation)
- The effect of the calving parity on the type of delivery
- The effect of calving parity on post-partum diseases (uterine infections were determined by a veterinary expert using rectal palpation)

Statistical analysis

SAS (2009) 9.2 version software was used to analyze the collected data. The Chi-square test was used to compare the obtained data.

RESULTS

The effect of calf sex on the type of delivery as well as on the post-partum diseases is shown in Tables 1 and 2.

These results indicated that among the total numbers of calving in this dairy farm, the ratios of born female calves and male calves were 53.62 % and 46.38 %, respectively. From them, the natural calving was represented at the highest percentage, whereas the dystocia showed the lowest percentage.

Table 1. The impact of calf sex on calving type

Sex	Calving rate (%)	Number of calving	Natural calving (%)	Auxiliary calving (%)	Dystocia (%)	Chi-Square
Bull calf	46.38	173	21.72	17.69	6.97	0.0250
Cow-calf	53.62	200	32.44	16.09	5.09	0.0250
The total of bull and cow-calves	100	373	54.16	33.78	12.06	0.0250

Chi-Square test

Table 2. The impact of calf sex on post-partum diseases (by percentage)

Sex	Ovarian cyst	Uterine infection	Chi-Square
Bull calf	6.90	48.28	0.9366
Cow-calf	5.75	39.08	0.9366
The total of bull and cow-calves	12.64	87.35	0.9366

Chi-Square test

Table 3. The impact of the number of parities on the type of calving (in percentage)

Parity No.	Natural calving	Auxiliary calving	Dystocia	Chi-Square
Parity 1	5.61	8.82	6.15	0.0001
Parity 2	9.89	8.56	2.67	0.0001
Parity 3	13.64	6.95	0.53	0.0001
Parity 4	12.57	6.15	1.07	0.0001
Parity 5	12.57	3.21	1.60	0.0001

Chi-Square test

From the total number of cows with the post-partum disease, 12.64 % had ovarian cysts, while 87.35 % had cervical infection. As the number of parities increased, the rate of natural calving increased as well (Table 3).

At the third parity most of the calvings were natural but after the third parity it decreased slightly. Assisted calving reached its lowest level at the fifth parity. In addition, as the number of parities increased, the dystocia was decreased, but it increased slightly after the third parity. This increase was lower at the fourth and fifth parities as compared to the first and second parities. Table 4 demonstrates the association of the number of parities with the incidence of post-partum diseases.

The ratio of ovarian cysts was notably increased by increasing the number of parities. However, this increase was evident up to the third parity and decreased thereafter. In addition, as the parities progressed, the rate of uterine infection also increased; however, it decreased after the second parity.

Table 4. The impact of the number of calving parity on the post-partum disease (in percentage)

Parity No.	Uterine infection	Ovarian cyst	Chi-Square
Parity 1	2.20	18.68	0.1800
Parity 2	4.40	27.47	0.1800
Parity 3	5.49	20.88	0.1800
Parity 4	0	10.99	0.1800
Parity 5	1.10	8.79	0.1800

Chi-Square test

DISCUSSION

Regarding the experimental results, it was found that the natural calving represented the highest percentage, whereas the dystocia represented the lowest percentage among the calvings. From the total number of cows suffering from post-partum diseases, 12.64 % were related to the ovarian cysts, while about 87.35 % were related to the uterine infection. Our investigations revealed that there was a positive relationship between the calving parity and time of first ovulation after calving. The first and second parities were longer than the first ovulation after calving as compared to the third and more parties. This can be probably due to the lack of energy and high nutritional stress for growth, in addition to lactation needs (Ferguson, 2005). However, it should be noted that there were also high-yielding cows with good reproductive performance (Sewalem *et al.*, 2010), which might be a result of better nutrition and more intensive care. On the other hand, those cows that were genetically determined for more production, although were not delayed in ovulation, but their nutritional deficiencies may have caused some ovarian problems (Dechow *et al.*, 2004).

Based on Table 1, it was concluded that the dystocia in the calving of male calves was considerably higher than that of female calves. By comparing the sexes of calves it was found that with the birth of male calves, the rate of the ovarian cysts and uterine infections became higher than before. Erb *et al.* (1985) reported that dystocia could cause some metritis and pregnancy problems and even lead to the elimination of livestock from the herd.

Some studies indicated that calf size was an essential factor in the type of calving. This is especially important for bull-calve calving. In terms of size, the bull-calves are larger than the cow-calves, which is one of the most important causes of dystocia (Hansen, 2000). Even calf births are the factor in dystocia (Correa *et al.*, 1993). A study conducted by Atashi and Asaadi (2019) showed a direct relationship between calf weight and pregnancy length. It was also noted that in the primiparous cows with a short gestation, the rate of dystocia was higher, it decreased and was found in multiparous cows with average length of gestation. Hammoud *et al.* (2010) stated that dystocia could cause some post-pregnancy diseases as well as some fertility problems. On the other hand, our results showed that as the number of parity increased, the rate of natural calving increased as well, while in the third parity, most of the calvings were natural. Here, it should be noted that the dystocia rate has also decreased by increasing the number of calving parity (Noakes *et al.*, 2009). However, one of the most critical factors in the type of delivery is the age and the body condition score of heifers at the time of insemination. It is worthwhile to mention that heifers should be timely inseminated, as late or early insemination may lead to pregnancy problems as well as to dystocia (Plate-Church, 2002).

It is known that the negative energy balances in high-yielding cows may decrease the reproductive performance as well as the livestock health, especially in first parity cows during early lactation (Wall *et al.*, 2003). This point is especially important in high-yielding cows (Lucy, 2001; Sewalem *et al.*, 2010; Stevenson *et al.*, 1999). The average age at first calving, which is an important indicator to determine the reproductive capacity in heifers and herd capacity to begin production, is between 24 and 25 months (Hare *et al.*, 2006). Faraji-Arough *et al.* (2011) reported that the most appropriate calving age for Holstein cows in Iran was 26.6 months (811.1 days).

The recent review (Noakes *et al.*, 2009) showed that age at first calving is influenced by some environmental and management factors, including proper breeding and nutrition in the pre-calving period. It would be appropriate if the age of first calving does not lead to creating such reproductive problems (Noakes *et al.*, 2009). In this matter, both ovarian cysts and uterine infection have increased significantly by increasing the number of parity. This is due to a relationship between the genetic association suffering from ovarian cysts and milk production. High-yielding cows become more susceptible to suffer from this problem in the first months after calving (Hansen, 2000; Lucy, 2001; Sewalem *et al.*, 2010). On the other hand, one of the major challenges in the reproductive problems in dairy cows are their age and body condition score during insemination (Plate-Church, 2002). Due to the lack of coordination between energy requirements and received energy, the high milk production rate may lead to the generation of a negative

energy balance in cows, which subsequently occurs at the beginning of lactation, when the weight losses and the body condition score is reduced (Lucy, 2000, 2001). Moreover, the mean age of first calving has an important impact on the reproduction capacity of heifers as well as on the capacity of the herd to begin production (Dechow *et al.*, 2004; Hare *et al.*, 2006).

Some researchers showed that cows that are genetically determined for further performance, although have no delay in ovulation, may be late in their first estrus after calving (Dechow *et al.*, 2004). In general, the low heritability and reproductive traits reveal that their variation is more dependent on non-genetic, i.e. environmental and management factors, such as nutrition and diagnostic management (Royal *et al.*, 2002). Some investigations showed that poor nutrition is a critical factor in weight loss that may cause some reproductive losses due to the lack of ovulation. Both overfeeding and obesity may cause a negative effect on reproduction by damaging the folliculogenesis and reducing the oocyte quality (Ferguson, 2005).

CONCLUSION

Of all calvings, natural calving had the highest number whereas the dystocia had the lowest. The rate of post-pregnancy problems was raised by the birth of male calves. It was also observed that as the numbers of parity increased, the rate of natural calving increased considerably, whereas the rate of uterine infections decreased. Nevertheless, the ovarian cyst incidence was increased slightly up to the third parity, while it was decreased after the third calving.

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