JOURNAL OF VETERINARY MEDICAL RESEARCH 2016, 23 (1): 17-24

Journal homepage:
http://www.bsu.edu.eg/bsujournals/JVMR.aspx

Online ISSN: 2357-0520 Print ISSN: 2357-0512

Original Research Article

Negative impact of metritis and endometritis on the reproductive performance in dairy cattle

Hussein M.M., Hassan A.G., Abdel-Halim B.R.*, Abdallah S.M.

Department of Theriogenology, Faculty of Veterinary Medicine, Beni-Suef University, Beni-Suef 62511, Egypt

ABSTRACT

The current study was conducted to investigate the incidence of metritis and endometritis in dairy cows and to determine their collective impacts on the reproductive performance and milk yield in dairy farms. Therefore, a total of 246 Holstein cows were divided into three groups; a control group (normal cows) and other two groups included cows those diagnosed with acute postpartum metritis and chronic endometritis, respectively. It has been found that endometritis had severe negative effects on the postpartum reproductive performance of diseased cows compared to normal ones. Moreover, the impact of such diseases was higher in premiparous cows compared with their pleuriparous herd-mates. Days to first estrus (P=0.06) tended to be increased in premiparous cows suffering from endometritis (89.19±12.12 days) compared to normal cows (59.45±3.30 days) or those suffering from acute metritis (65.37±4.92 days). In pleuriparous cows, negative effects of endometritis had no tendency for prolonged days to first estrus, compared to normal cows. Endometritis had significantly (*P*<0.01) negative impacts on the postpartum cyclicity in premiparous cows (89.19±12.12 days) compared to pleuriparous cows (56.32±3.15 days). Significantly (*P*<0.05), endometritis showed negatively impacted days to the first AI in premiparous cows (105.63±12.95 days) rather than normal cows (65.97±2.63 days) and pleuriparous cows (76.19±3.64 days). More or less similar trend was observed for endometritis and metritis regarding their potential negative impacts on the number of inseminations per conception in both premiparous and pleuriparous cows. Concerning days open, diseases such as endometritis was associated with significantly (*P*<0.01) higher in both premiparous and pleuriparous cows. Meanwhile, advancing parity was associated with significantly (*P*<0.05) higher in cows suffering from endometritis only.

ARTICLE INFO

Article history:

Received: 12 May 2016
Accepted: 20 June 2016
Available online: 8 August 2016

Keywords:

Metritis, endometritis, milk yield, reproductive performance

* Corresponding author: Tel.: +2 0822322066.; fax: +2 0822327982. drbakarwa@yahoo.com (Dr. Bakar R. Abdel-Halim)

1. Introduction

Several physiological alterations take place in the cow's uterus soon after calving, and they are considered to be significant if a cow is recovering and it comes back into the season, ready to conceive. Thus, factors that interfere with the normal functioning of the uterus and other associated structures will affect the overall reproductive performance (Mukasa-Mugerwa, 1989). The postpartum uterine infection represented one of the main factors affecting the aforementioned physiological changes (Sheldon and Dobson, 2004).

Despite a lack of precision and variations among research reports, definitions of uterine infections in cattle have been extensively reviewed and expressed (Foldi et al., 2006; Palenik et al., 2009; Potter et al., 2010). Whilst it is not always possible to group animals with uterine infections, some definitions have been superimposed. Puerperal metritis can be defined as an acute systematic illness referred to a uterine infection by pathogenic bacteria, usually within 10 days after parturition (Sheldon and Dobson, 2004 and Williams et al., 2008).

Uterine infections have a negative impact on the animal welfare and reproductive performance leading to major economic losses (Sheldon, 2004). The incidence of clinical metritis in cows (18.6%) and heifers (30%) has been reported (Williams et al., 2005). Sheldon et al. (2006) determined that the incidence of clinical metritis during the first two weeks of the postpartum period was 25%-40%. It has been indicated that the incidence of clinical metritis at the herd level was 5%-26% (17%) (Ghanem et al., 2002). Furthermore, subclinical endometritis has been reported 19%-74% (53%) (Gilbert et al, 2005; Plöntzke et al., 2010). Variations in such studies have been attributed to the diagnostic methods employed, the method used for the classification of uterine infections, the postpartum period in which the uterine infection was diagnosed, the general traits of the bovine animals and their parity, and the management of the herds included (Azawi, 2008).

The exact risk factors associated with postpartum uterine infections in cows are unknown. However, several investigations have identified some of them and found that they vary among regions/countries as a result of discrepancies in general management, environment and herd health conditions (Kim and Kang, 2003; Bell and Roberts, 2007; Potter et al., 2010). Various risk factors related to management and individual variation has been identified. They included retained fetal membranes (Abdelhameed et al., 2009), dystocia (Garry, 2004), age (Sheldon et al., 2006), parity (Gautam et al., 2009) calving season (Buckley et al., 2010), breed (Potter et al., 2010) and nutrition (Bell and Roberts, 2007).

It has been estimated that for each 100 cows served for the first time, approximately 30% live births occur, suggesting that the uterine infection is one of the promising causes of reduced fertility in many dairy herds (Dobson et al., 1999). LeBlanc (2002) found that the conception rate was 20% lower in cows with endometritis, with a median calving to conception interval of 30 days longer and approximately 35% more animals were culled for failure to conceive. Similarly, McDougall et al. (2011) and Lee and Kim (2006) showed increased culling and reduced pregnancy rates in cows with uterine infections, however, Gilbert et al. (2005) found endometritis was highly significant for reduced pregnancy rates where days open was 218 and 118, first service pregnancy rate 11% and 36% and pregnancy until day 300 postpartum 63% and 89% in cows with/without uterine infections in a dairy herd in the US. Gautam et al. (2009) found that clinical endometritis diagnosed in the late postpartum period (29-60 days) decreased pregnancy rate. Bell and Roberts (2007) reported that the uterine infection had a great impact on the dairy cow health and welfare and the subsequent reproductive performance. Sheldon and Dobson (2004) highlighted that financial losses associated with uterine infections are dependent on the reduced milk yield, cost of treatment and subfertility. It has been found that a worldwide significant loss of 2.5 billion Euros/ annum in the dairy industry was due to postpartum uterine infections (LeBlanc et al., 2002).

The objective of the study was to identify, at the lactation level, the postpartum risk of uterine infections on time to first estrus, number of inseminations per conception and days open in a commercial dairy herd.

2. Material and methods

2.1. Study area and animals

The present study was conducted on 246 Holstein cows belonging to El-Lahamy dairy farm in El Fayoum province (coordinates: 29.308374°N 30.844105°E), Egypt. Animals were divided into 3 groups:

Group 1(control group): 99 normal cows (33 premiparous and 66 pleuriparous).
Group 2: 78 cows (38 premiparous and 40 pleuriparous) suffered from acute postpartum metritis within 15 days postpartum.
Group 3: 69 cows (16 premiparous and 53 pleuriparous) suffered from chronic endometritis.

Cows were raised in an open yard system with a muddy land and were fed TMR according NRC (2001). They were milked three times a day and were distributed in yards according productive and reproductive status. Dairy life program was used to record system and all events were estimated daily. Fresh cows (recently calved cows till 28 days postpartum) raised in a separate yard to follow up especially for checking up postpartum metabolic disorders, retained fetal membranes and uterine infections. Rectal temperature was recorded for 10 days postpartum and fecal score was done by herd manager daily. The diagnosis of acute postpartum metritis was dependent on clinical signs, mainly systemic, including high temperature (> 39.5º C), off feed, putrid uterine discharge, low milk production and abnormal attitude. Diagnosis of chronic endometritis based on the observation of abnormal uterine discharge at lying, at an estrus phase, or during routine rectal examinations and ultrasonography. Treatment of acute postpartum metritis was mainly dependent on the systemic treatment, while that of endometritis was according to the injection of PGF2α along with intrauterine antibiotics.

2.2. Reproductive management

Detection of estrus was done by herdsmen and milking employees via visual observations, and artificial insemination was done on AM and PM basis. Pre-Synch, Ov-Synch and Re-Synch programs were routinely performed. Pr-synch program was used especially for cows diagnosed with endometritis to clean up cows.

3. Statistical analysis

Statistical analyses were performed using SPSS (2013). Pearson's correlation coefficient of factors was used to compare findings between variables. Data are presented as means ± SEM.

3. Results

It was clear that endometritis possessed severe negative effects on the postpartum reproductive performance of the surveyed cows compared with normal animals. Moreover, the impact of that disorder was higher in premiparous cows, compared with their herd mates of pleuriparous. Days to first estrus tended (P=0.06) to be increased in premiparous cows suffering from endometritis (89.19±12.12 days) compared with normal cows (59.45±3.30 days) or those suffering from metritis (65.37±4.92 days). Significantly (P<0.05), endometritis induced a negative impact on days to first insemination in both premiparous (105.63±12.95 days) and pleuriparous cows (76.19±3.64 days) compared with normal animals. More or less trend was observed for metritis and endometritis regarding their potential negative impacts on number of inseminations per conception in both premiparous and pleuriparous cows. Concerning days open, endometritis was associated with significantly higher (P<0.01) days open in both premiparous and pleuriparous cows. Meanwhile, advancing parity was associated with significantly higher (P<0.05) days open for cows suffering from endometritis only (Table 1).

2.1. Pearson's correlation coefficients (r) between production parameters and reproductive problems in Holstein cows

The most prominent result was a significantly negative correlation between metritis and 305 day milk yield (r=-0.10, P<0.05) (Table 2).

3.2. Relationship between parity and incidence of metritis in Holstein cows

In the present work, metritis had no association with parity in Holstein cows (R^2=0.006). The incidence of metritis was 33.3% in first lactation cows, reached a minimum of 8.8% in the third parity cows and increased to 32.14% in the fifth parity cows (Fig. 1).

3.3. Relationship between parity and incidence of endometritis in Holstein cows

It has been found that the incidence of endometritis increased with advancing parity varying from 14.04% for premiparous cows to 21.88% for the 4th lactation cows. Interestingly, all points were so close to the slope of the regression line (R^2=0.87). The slope of the equation was a one point increase in parity was associated with a 1.88 points increase in the incidence of endometritis (Fig. 2).

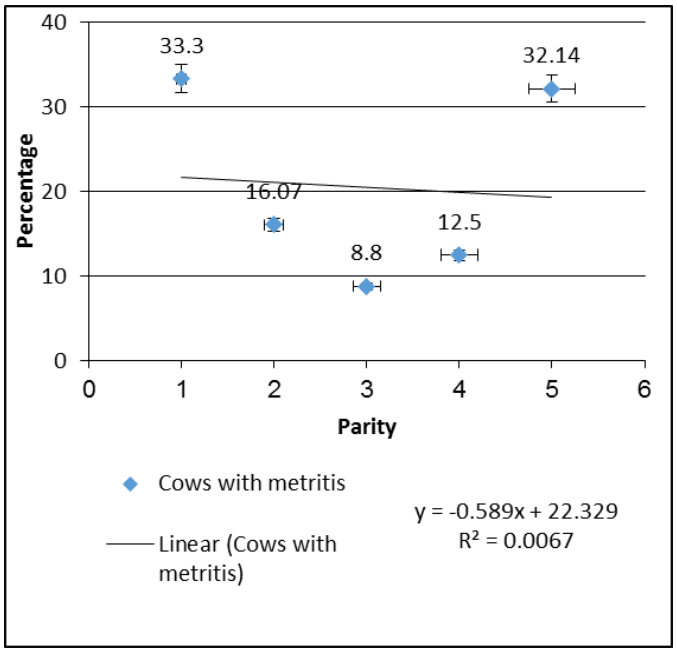

Figure 1. Incidence of metritis according to parity in Holstein cows

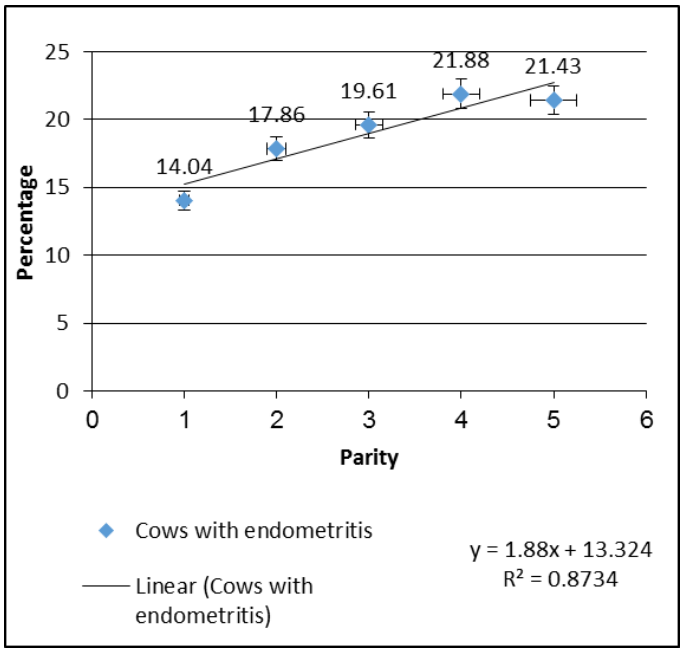

Figure 2. Incidence of endometritis according to parity in Holstein cows

Table 1. The effects of acute postpartum metritis and chronic endometritis on fertility indices.

	Days to first estrus		Days to first AI		NIPC		Days open	
	Premiparous	Pleuriparous	Premiparous	Pleuriparous	Premiparous	Pleuriparous	Premiparous	Pleuriparous
Control (33 vs. 66)	59.45± 3.30[a]	53.86± 2.17	65.97± 2.63[a]	66.61± 1.44[a]	1.94± 0.26[a]	2.44± 0.19[a]	109.40± 12.59[a]	111.79± 5.86[a]
Metritis (38 vs. 40)	65.37± 4.92[a]	57.13± 2.86	81.24[ab]± 5.83[ab]	75.25± 3.93[ab]	3.20± 0.39[ab]	4.25± 0.58[b]	165.45± 16.14[ab]	175.40± 16.59[b]
Endometritis (16 vs. 53)	89.19± 12.12[b]	56.32± 3.15	105.63± 12.95[b]	76.19± 3.64[b]	4.06± 0.84[b]	3.34± 0.34[ab]	210.88± 21.84[b]	156.70± 11.61[b]
P value	0.06	0.37	0.03	0.02	0.03	0.01	<0.01	<0.01

AI: Artificial insemination; NIPC: number of inseminations per conception. Values are expressed as means ± SE.
Means within the same column with different alphabetical are significantly different at $P< 0.01$.

4. Discussion

Dramatically, endometritis impairs the reproductive performance of high yielding dairy cows due to persistent bacterial infection, which leads to inflammation and damage to the endometrium thereby, prolonging uterine involution and impairing fertility (Fourichon et al., 2000; Kasimanickam et al., 2004). The obtained findings revealed that endometritis had severe negative effects on the postpartum reproductive performance of examined cows. Moreover, premiparous cows were more affected than pleuriparous herd-mates. Such results came in agreement with Miller et al. (1980) who found that the diagnosis of endometritis by rectal palpation or by observation of the genital discharge is insensitive and non-specific. Földi et al. (2006) and Palmer (2008) reported that diagnosis of clinical

endometritis using palpation per-rectum is subjective, not effective and prone to error as it lacks standardization. Pleuriparous cows had a greater tendency to accumulate fluid in their uteri than premiparous cows. Moreover, Lee and Kim (2006) detected that the parity increases milk yield, body condition loss during early lactation, the risk of periparturient disorders, and culling due to reproductive failure in dairy herds. Meanwhile, the prevalence of subclinical endometritis has been reported to be similar in premiparous and pleuriparous cows (Cheong et al., 2011). A high milk production and the parity showed associations with an excessive body condition score loss (Tsousis et al., 2009). Some literature found that the parity is a factor affecting conception rates (Kaufmann et al., 2009) or the chance of insemination and pregnancy (Pleticha et al., 2009). Lincke et al. (2007) revealed opposite findings.

Table 2. Pearson's correlation coefficient (r) between production parameters and reproductive problems in studied Holstein cows.

	Metritis	Endometritis
Peak milk	-0.08	-0.06
Peak day	0.05	-0.01
100-day milk	-0.06	-0.03
305-day milk	-0.10*	0.03

* Significant correlation at $P<0.05$.

Previous literature showed either high or low BCS that has been related to greater incidences of metritis, retained placenta, milk fever, lameness, cystic ovaries, dystocia, displaced abomasum, and mastitis. Titterton and Weaver (1999) observed higher uterine discharge scores for cows calving with BCS ≤3.25 (US BCS) or ≥4.25 (US BCS) than for cows calving with BCS of 3.0. On the other hand, Kadivar et al. (2014) concluded that low BCS is a risk factor for postpartum endometritis and delayed cyclicity in dairy cows. Moreover, Heuer et al. (1999) reported that endometritis occurred after 20 days postpartum in thin cows. Cows with BCS at calving <3.0 were more likely to have metritis than those with a higher BCS at calving. Markusfeld et al. (1997) demonstrated that cows losing more BCS during the dry period were more likely to experience metritis. Kasimanickam et al. (2013) stated that cows with metritis or clinical endometritis had lower or lost body condition compared with those with subclinical endometritis or normal cows. Meanwhile, Waltner et al. (1993) failed to identify a relationship between BCS and metritis. BCS has previously been reported as a risk factor for subclinical endometritis in pasture-grazed cows (McDougall et al., 2011) increased body fat mobilization, as evidenced by elevated NEFA concentrations, was associated with an increased risk of metritis (Duffield et al., 2009).

In the current investigation, days to first estrus tended (P=0.06) to be increased in premiparous cows suffering from endometritis (89.19±12.12 days) compared with normal cows (59.45±3.30 days) or those suffering from metritis (65.37±4.92 days). In pleuriparous cows, the negative effects of endometritis had no tendency for prolonged days to first estrus. There may be an antagonistic relationship between milk yield and reproductive performance (Butler and Smith, 1989). However, Shanks et al. (1979) suggested that high yielding cows might be more reproductively sound because they are healthier than lower yielding cows. Loss of milk production appears to be confined to individuals that progress to clinical metritis (Fourichon et al., 2000). Premiparous cows produced more milk had increased odds of having subclinical endometritis, whereas pleuriparous cows produced more milk had decreased odds of having subclinical endometritis (Cheong et al., 2011). Subclinical endometritis is likely the result of impaired uterine immune function as a result of a negative energy balance and a mechanism of energy balance affecting reproduction.

The interaction between milk production and parity was strongly associated with the risk of subclinical endometritis. In the authors' opinion, that might be due to variations in experimental design, production system, and feeding regime. LeBlanc et al. (2002) reported that cows with mucopurulent or worse uterine discharge that persisted beyond 60 DIM had a more pronounced reduction in pregnancy rate than cows with endometritis diagnosed < 60 DIM. In the present study, endometritis, significantly ($P<0.05$) had negative impact days to first AI in both premiparous cows (105.63±12.95 days, compared with 65.97±2.63 days in normal cows and pleuriparous cows (76.19±3.64 days), compared with 66.61±1.44 days in normal cows. Similar trend was observed for endometritis and metritis regarding their potential negative impacts on the number of inseminations per conception in both premiparous and pleuriparous cows. Regarding to, days open,

diseases like endometritis was associated with significantly (P<0.01) higher days open in both premiparous and pleuriparous cows. Meanwhile, the advancing parity was associated with significantly (P<0.05) higher days open for cows suffering from endometritis only.

5. Conclusion

Postpartum metritis and lameness represented the most prevalent disorders among primiparous cows. The lowest 305-day milk recorded was 7,430.33 Kg in primiparous cows with metritis and 8,153.56 Kg in pluriparous cows with RFM. Moreover, endometritis possessed the severest negative effects on postpartum reproductive performance of cows. Meanwhile, the incidence of endometritis increased with advancing parity in the current study varying from 14.04% for primiparous cows to 21.88% for 4th lactation cows. In the present investigation, metritis had no relationship with parity in Holstein cows (R2=0.006).

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