Fertility challenges in dairy cows with purulent vaginal discharge: Implications for reproductive efficiency

BOUDELAL SALEH[1] *, ADNANE MOUNIR[2]

[1] Department of veterinary science, University of Laghouat, Laghouat 03000, Algeria.
[2] Institute of veterinary science, Department of biomedicine, University of Tiaret, Tiaret, 14000, Algeria.

SUMMARY

Reproductive tract inflammatory diseases are major contributors to infertility in dairy cows, with purulent vaginal discharge (PVD) being a significant uterine disorder affecting both milk production and fertility. This study aimed to investigate the impact of PVD on key reproductive performance parameters in Algerian dairy farming conditions. The study analyzed several parameters: conception rates at first service, conception rates at 150 days in milk (DIM), interval days to first service, interval days to fertilization and services per conception. PVD diagnosis and fertility data were collected from 78 dairy cows (36 healthy and 42 diagnosed with PVD) using vaginoscopy at 21-38 DIM. While there was no significant difference in conception rates at first service between the two groups, cows with PVD had a 32.1 % lower conception rate at 150 DIM ($p < 0.05$). Additionally, PVD-affected cows had a median calving to first service interval and a median calving to fertilization interval that were an average of 18 and 22 days longer, respectively, than those of cows free of PVD ($p < 0.05$). Furthermore, cows diagnosed with PVD required 1.08 services more to achieve pregnancy compared to healthy cows without signs of disease ($p < 0.05$). These findings shed light on the detrimental effects of PVD on reproductive performance, underscoring the need for improved herd management practices, adequate prevention and effective treatments to mitigate its impact.

KEY WORDS

Uterine disorder; Dairy cows; Infertility; Impact; Reproductive performance.

INTRODUCTION

Reproductive efficiency remains a pivotal determinant of herd productivity and economic viability in dairy cattle production systems (1). Poor performance often stems from postpartum inflammatory diseases, such as purulent vaginal discharge (PVD) (2; 3). Defined as endometrial inflammation associated with a purulent or mucopurulent discharge detected at or after 21 days postpartum (4; 5), PVD have been identified as significant contributors to suboptimal fertility outcomes and cause substantial economic losses for dairy industry (6; 7). The chronic inflammatory milieu within the uterine environment, characterized by elevated cytokine levels and disrupted immune tolerance, is thought to underlie adverse reproductive outcomes. These conditions decrease conception rate, extends calving intervals, increases the number of services per pregnancy and higher pregnancy losses (8; 9; 10). Beyond, this direct impact on fertility, the economic losses arise also from treatment cost, reduced milk production, and increased unprofitable culling (11; 12; 13), with each case is estimated to cost approximatively €160-€420 (14).

The reproductive performance of dairy herds in many countries, including Algeria, is substandard, as evidenced by an extended calving interval averaging 452.1± 31.7 days (15). Epidemiological data reveal alarmingly low first-service conception rates (25%), and a high incidence of multiple inseminations required per conception (40%) in the northeastern region (16). A significant proportion of this reproductive inefficiency is attributable to uterine disorders, with PVD affecting approximately 37% of postpartum cows in Algerian herds (3). Furthermore, abattoir-based investigations have reported a uterine infection prevalence of 15.58% in slaughtered females (17), underscoring the broader implications of uterine pathologies for herd management and industry sustainability

To the best of our knowledge, no Algerian study investigating the specific impact of PVD on reproductive performance in dairy cattle has been published. This study aims to elucidate the specific effects of PVD on critical reproductive performance metrics, including days to first service, conception rates at first service and at 150 days in milk (DIM), interval day to first service, interval days to fertilization and number of services per conception in Algerian dairy herds. The findings are intended to inform targeted interventions for the management of PVD and optimization of reproductive efficiency in dairy production systems.

MATERIALS AND METHODS

Study area and farms

This study was conducted on six dairy farms in Tiaret area. The region is characterized by a sub-continental climate, which often has a significant annual variation in temperature, with minimum and maximum temperature of -5 °C and +45 °C, re-

*Corresponding Author:
Boudelal Saleh (s.boudelal@lagh-univ.dz)

spectively. The average annual rainfall is 350mm, with most precipitation occurring from November to February. The farms were selected based on uniformity in herd management practices and geographical proximity.

Animals and management

The study included a total of 78 multiparous Holstein-Friesan cows, categorized in two groups based on their vaginal discharge score (VDS): 36 healthy cows (PVD-negative) and 42 cows with PVD (PVD-positive). The cows were housed under a loose housing system and managed without reproductive synchronization protocols. Rations were formulated based on lactational requirements, comprising meadow fodder or corn silage, supplemented with vetch-oats hay and commercial concentrates. Water was provided *adlibitum*. Average 305-day milk production ranged from 4000 to 4500 kg across the farms. Milking was conducted twice daily, and the voluntary waiting period was standardized at 50 days post calving. No hormonal, anti-inflammatory or antibiotics treatment were administered to any of the animals included in the experimental protocol, before or during the study.

Inclusion criteria

Only cows exhibiting eutocic calving were enrolled. Exclusion criteria included cows with histories of cesarean section, vaginal lacerations, mastitis, lameness, or concurrent systemic illnesses that could confound reproductive performance parameters.

PVD diagnosis

PVD was diagnosed during early postpartum (21-38 days in milk, DIM) via vaginoscopy, following the guidelines described by (1). Vaginal discharge scoring (VDS) was applied on a 4-point scale: score 0 = clear mucus; score 1= mucus with flecks of pus; score 2= mucopurulent discharge with < 50% of pus; score 3= purulent discharge with 50% of pus. Cows with a VDS ≥ 1 were classified as PVD-positive, while those scoring 0 were considered PVD-negative.

Reproductive parameters

Several reproductive parameters were evaluated for the two PVD groups. Days to first service (DSI) which refers to the interval (day) from calving to first insemination. Conception rate at first service (CRFS%) which represents the proportion of cows pregnant after the first insemination. Days to fertilization (DFI) is the interval (days) from calving to conception. The number of services per conception (NSPC) stands for total inseminations required for successful pregnancy. Conception rate at 150 DIM (CR150%) is the proportion of cows confirmed pregnant by 150 DIM. Pregnancy diagnosis was performed using transrectal ultrasonography at 35±5 days post insemination.

Statistical analysis

Data analyses were performed using SPSS (version 24.0, IBM corp, Armonk, NY, USA). Comparison of CRFS% and CR150% between groups were conducted using Chi-square test. Median DSI, DFI, and NSPC were compared using the Mann-Whitney U-test, with results expressed as means ± standard deviations (SD). Statistical significance was set at $p < 0.05$.

RESULTS

The effect of PVD on reproductive outcomes are presented in Table 1. The analysis revealed significant differences in reproductive performance parameters between PVD-negative and PVD-positive cows.

Conception rates

No significant difference was observed in CRFS% between the two groups, with PVD-negative achieving a rate of 36.1% compared to 33.3% for PVD-positive cows (p 0.05). However, the risk of conception at 150 DIM was 1.7 times higher in PVD-negative cows than in PVD-positive cows ($p < 0.05$).

Intervals

Cows diagnosed with PVD exhibited a significantly longer DSI compared to healthy cows, with an average increase of 18 days ($p < 0.05$). Similarly, DFI was prolonged by a 22-day increase in PVD-positive cows, compared to PVD-negative cows ($p < 0.05$).

Services per conception

NSPC was also significantly higher in PVD-positive cows with 1.08 additional services per cows compared to healthy cows ($p < 0.05$).

DISCUSSION

The PVD affects fertility mainly because it is an infection and inflammation of the uterus, which interferes with the reproductive system role in cyclicity, conception and pregnancy. The findings of this study demonstrate the profound negative impact of PVD on key reproductive performance indicators in dairy cows. While no significant difference was observed in the CRFS% between PVD-positive and PVD-negative cows, other metrics were markedly impaired in PVD-positive cows. This underscores the complexity of PVD effects on fertility, which may not uniformly affect all reproductive parameters.

Table 1 - Reproductive performance metrics of PVD-negative and PVD-positive cows.

Parameter	PVD-negative (n= 36)	PVD-positive (n=42)	P-value
Median days to first service (DSI)	59.94 ± 11.64[a]	77.62 ± 20.00[b]	0.002
Median days to fertilization (DFI)	76.21 ± 17.74[a]	97.71 ± 34.69[b]	0.037
Number of services per conception (NSPC)	1.75 ± 0.69[a]	2.83 ± 0.86[b]	0.031
Conception rate a first service (CRFS%)	36.1% (13/36)	33.3% (14/42)	0.79
Conception rate at 150 DIM (CR150%)	75% (27/36)[a]	42.9 (18/42)[b]	0.004

Value within a row with different superscripts (a, b) indicate statistical significance ($p < 0.05$)

Conception rates

The reduced CR150% in PVD-positive cows further underscore the long-term reproductive consequences of this condition. The conception rate for PVD-positive cows in this study (42.9%) was substantially lower than the 75% observed in PVD-negative cows. This finding aligns with those of (18), who reported that the pregnancy rate differed between females with mucopurulent discharges and healthy ones. The study indicated that cows with PVD had a significant reduction of 47% in pregnancy rates compared to healthy cows (18). An investigation conducted by (11) revealed that cows with PVD were three times less likely to conceive. Likewise, the presence of abnormal vaginal discharges was associated with reduced pregnancy rate within 100, 150, and 210 DIM (1). In the same context, PVD-positive cows had lower pregnancy rate compared to PVD-negative group, resulting in a lower conception rate by 360 DIM (66% vs 78%) (19). The persistent effects of PVD on reproductive efficiency are likely due to the direct impact of endometrial inflammation on uterine function and cyclicity (2; 8; 20).

Intervals

The prolonged DSI observed in PVD-positive cows aligns with previous studies, which consistently reported delayed postpartum ovarian activity and estrous expression in cows suffering from uterine disorders leading to reproductive failure (21; 22). The increase of approximately 18 days in DSI for PVD-positive cows in this study mirrors findings from (23) and (24), who documented delays of 23 and 14 days, respectively in cows with endometrial inflammation. This delay is likely attributable to the inflammatory environment within the uterus, which can interfere with follicular development and maturation (8).

PVD also extends length of time it takes for cows to fertilize following calving, leading to longer calving intervals. The significantly prolonged DFI in PVD-positive cows further highlights the detrimental impact of uterine inflammation on fertility. The average delay of 22 days observed in this study is consistent with prior reports by (6) and (23), who found increases of 28 and 36 days in the calving to conception interval in cows diagnosed with uterine infections, respectively. Our findings consistent with those of (25), who reported that induced endometrial inflammation with *E. coli* and *T. pyogenes,* relevant pathogens of PVD, extended the median days open by 24 days. A healthy reproductive tract is required to ensure successful fertilization, favorable embryo implantation and normal fetal development (26; 10).

Services per conception

Another critical finding is the higher NSPC required for PVD-positive cows (1.08 higher than PVD-negative cows). This increase indicates reduced conception efficiency, which may stem from persistent uterine inflammation and altered uterine microenvironment conditions that impede sperm viability, fertilization, or embryo development (5; 27). In concordance with our findings, a study by (28) also demonstrated significant impairments in reproductive performance in cows with PVD, including longer intervals to conception, a higher number of services per conception, and a lower total pregnancy rate. Similar observations were made by (19), who reported that PVD-affected cows required significantly more inseminations to achieve pregnancy compared to healthy ones. Fertility decline due to PVD is also partly related to a higher risk of repeat breeding, where females are often bred or inseminated before achieving pregnancy.

CONCLUSION

The study provides robust evidence of the detrimental effects of PVD on reproductive efficiency in dairy cows in the Algerian farming conditions. The economic implications of these reproductive inefficiencies cannot be overlooked and prolonged calvings intervals, increased insemination costs, and reduced pregnancy rates translate into substantial financial losses for dairy producers. The fundings highlight the importance of targeted management strategies and adequate preventive approaches. Accordingly, routine postpartum screening, specific treatment protocols, and adequate feeding and management during the peripartum should also reduce PVD prevalence and mitigate the adverse impacts of PVD on herd fertility in Algerian farming conditions.

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Competing Interests

The authors have no relevant financial or non-financial interests to disclose.

Author Contributions

Conceptualization: [BS]; Methodology: [BS]; Formal analysis and investigation: [BS, AM]; Writing original draft preparation: [BS]; Writing - review and editing: [BS, AM]; Supervision: [AM]. All authors read and approved the final manuscript.

Ethics Approval

Ethical approval was not required for this study, as the procedures involved only vaginoscopic examination, which is a standard non-invasive diagnostic protocol.

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