

EFFECT OF PUERPERAL METRITIS ON HOLSTEIN COWS PRODUCTIVE, REPRODUCTIVE VARIABLES AND CULLING RATES

¹Dawod, A. and ²Byeng R. Min

¹Department of Husbandry and Animal Wealth Development,
Faculty of Veterinary Medicine, Sadat City University, Egypt

²Department of Agricultural and Environmental Sciences, Tuskegee University, Tuskegee, AL, USA

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ABSTRACT

The objective of the study was to determine the effect of puerperal metritis prevalence in high yielding Holstein cows on productive (305 days, actual milk yields), reproductive (days to first estrus, days open and services per conception) variables and culling rates. Throughout the study, 2885 dairy records were collected from high yielding private Holstein dairy farm (average milk yield was up to 9000 kg) for 3 successive lactation seasons. Dairy cows were classified according to their uterine affection into two groups, healthy and those with puerperal metritis. Dairy cows which affected with puerperal metritis were diagnosed during the first 3 weeks of lactation. Metritic cows were diagnosed and treated at the discretion of the herd veterinarian. Affected dairy cows were grouped into four groups according to time of the puerperal metritis attack during the first 21 Days In Milk (DIM) as (<5; 5-10; 10-15 and >15 DIM, respectively). Moreover, the dairy females were grouped into 3 groups according to frequency of puerperal metritis of once, twice and triple, respectively. Dairy cows were also grouped according to their calving season (winter, spring, summer and fall calving seasons). Productive, reproductive variables and culling due to puerperal metritis were detected from the on-farm record system (DairyComp305). Results of this study revealed that, puerperal metritis had bad effects on high yielding cows productive and reproductive variables, that decreased the 305 milk yield, increased days to first estrus, days open and number of services per conception. Moreover, the occurrence of puerperal metritis increased during the warm months of spring and summer seasons. Also, the occurrence of such disease was increased during the first 10 days of postpartum as (89.98%) of the affected cases occurred within this period. Care must be directed to dairy cows which had a history of puerperal metritis as these cases had a greater tendency for recurrence. Also, the re- attacked cows with puerperal metritis had a great chance to be culled from the dairy herds, as they reached to (53.33% and 100%) for the second and third attack, respectively.

Keywords: Puerperal Metritis, Dairy Cows, High Yielding Holstein, Culling Rate, Milk Yield, Reproduction

1. INTRODUCTION

The lactating dairy cow is not as fertile as she was before. Healthy transitions phase together with smooth calving are critical for the dairy cows lactation performance. Hence that many health hazards may

face dairy cows during their transition phase, thus mainly due to suppressed immune system and negative energy balance. Dairy cattle postpartum immune suppression increased the susceptibility of the dairy animal to both metabolic and infectious diseases (Dawod, 2011).

Corresponding Author: Dawod, A., Department of Husbandry and Animal Wealth Development, Faculty of Veterinary Medicine, Sadat City University, Egypt

One of the most common critical hazards facing early fresh cow during their early lactation phase is the puerperal metritis. Most often metritis was diagnosed within dairy cow's puerperal phase, as it concerns with many dairy cattle problems such as reduced milk production and reproductive fitness during and after the course of the disease (Wittrock *et al.*, 2011).

Puerperal metritis is defined as a diseased case characterized by abnormally enlarged uterus with watery red-brown uterine discharge associated with signs of systemic illness like decreased milk yield, dullness or other signs of toxemia and fever $>39.5^{\circ}\text{C}$, within the first 21 days after parturition. Some other metritic cases exhibited abnormally enlarged uterus with a purulent uterine discharge detectable in the vagina with no systemic signs during the first 3 weeks after calving (Sheldon *et al.*, 2006). Lactating dairy cows suffered from a high incidence of metritis reached to 20% with wide incidence range (8- $>40\%$) in some dairy herds (Goshen and Shpigel, 2006; Hammon *et al.*, 2006; Huzzey *et al.*, 2007; Galvão *et al.*, 2009b).

Unfortunately, dairy cows were subjected to metritis during their puerperal phase with a higher incidence rate which reached to 10% and may exceed in some dairy herds to go up to 20% (Kelton *et al.*, 1998). Numerous research studies proofed that puerperal metritis had a very huge negative impacts upon dairy herd performance, which caused severe economic losses (LeBlanc *et al.*, 2002; Gilbert *et al.*, 2005). Some expert opinions suggest that, given effective treatments to such disease cases were not of a great efficacious and effort should be focused on dairy herd management strategies to govern puerperal metritis predisposing and risk factors (Galvão, 2013). In concurrent work, effect of puerperal metritis occurrence in high yielding dairy Holstein cows will be studied on productive and reproductive performance. Moreover, its time of attack, attack frequency and culling percentage will be studied for 3 successive lactation seasons.

2. MATERIALS AND METHODS

The study was done within a private dairy farm of high yielding Holstein cows located in Giza governorate, Egypt within the period from December, 2013 to February, 2014. The dairy enterprise was considered as one of the high yielding dairy farms as its average milk yield reached up to 9000 kg milk per season. Throughout the study, about 2885 farm records were collected for 3 successive lactation seasons. The occurrence of puerperal metritis in dairy cows was investigated for

several times during the 3 successive lactation seasons using their veterinary health records.

The diagnosis of metritic females was done via herd veterinarian, that the dairy cows which suffered from abnormal enlarged uterus, red-brown watery uterine exudates, high febrile condition ($>39.5^{\circ}\text{C}$), general toxemia, loss of appetite and decrease of milk yield during the first 21 days postpartum were diagnosed to be metritic cows (Sheldon *et al.*, 2006). Treatments of such affected cases were done according to standards of herd metritis treatment strategy. Dairy cows were grouped into two main groups according to their uterine affection, as the first affected with puerperal metritis, while the second was healthy (Overton and Fetrow, 2008), other dairy cattle diseased cases were discarded from the data. Dairy cows were grouped according to time of the puerperal metritis attack during the first 21 Days In Milk (DIM) into 4 groups, (<5 ; 5-10; 10-15 and >15 DIM, respectively). Cows were also grouped into three groups according to the frequency of puerperal metritis occurrence, as of once, twice and triple, respectively. Dairy cows were grouped according to their calving season into 4 groups for winter, spring, summer and fall calving seasons, respectively (Dolezel *et al.* 2008).

2.1. Statistical Analysis

Data of 305 days, actual milk yields, days to first estrus, days open, number of services per conception, metritic diseased cases and their culling were collected and obtained from the on-farm record system (DairyComp 305). All data were subjected to further statistical analysis with SPSS analytical software (SPSS, 2006). The effect of the calving season on the puerperal metritis attack, repeated attack on cull and return ratios were done via chi square test according to (Campbell, 2007). The effect of the puerperal metritis upon milk production (305 and actual milk yield) and reproduction (days to first estrus, days open and service per conception) were done using independent t-test according to (McDonald, 2009).

3. RESULTS

3.1. Effect of Puerperal Metritis Prevalence on Dairy Holstein Cows Productive Performance

Concerning to the effect of puerperal metritis prevalence on dairy Holstein cows milk yield **Table 1**, it was clearly that the puerperal uterine status influenced 305 days as well as actual milk yield values significantly. As, the dairy cows which suffered from metritis during their puerperal phase decreased significantly 305 days

milk yield (9461.58 ± 292.45 kg) than normal ones (10087.17 ± 74.66 kg) at ($p < 0.01$). The same trend appeared clearly within actual milk yield results, that metritic females decreased significantly the actual milk yield value (11833.04 ± 452.57 kg) than normal cows (12015.67 ± 174.66 kg) at ($p < 0.01$).

3.2. Effect of Puerperal Metritis Prevalence on Dairy Holstein Cows Reproductive Performance

From **Table 2**, it was clearly that the reproductive performance possessed significant difference among different uterine statuses in dairy Holstein cows, as the puerperal metritic Holsteins increased significantly days to first estrus, days open and number of services per conception values (77.60 ± 4.09 days; 158.49 ± 4.85 days and 2.77 ± 0.10 , respectively) than normal ones (48.00 ± 4.19 days; 91.17 ± 7.78 days and 1.88 ± 0.27 , respectively).

3.3. Effect of Days in Milk (DIM) on Puerperal Metritis Prevalence among Dairy Holstein Cows

Regarding to effect of Days In Milk (DIM) upon puerperal metritis prevalence in dairy Holstein cows **Table 3**, it was evident that the dairy cattle DIM influenced significantly puerperal metritis among dairy herd. This trend expressed via chi square test (chi square value $\chi^2 = 89.98^{****}$) at ($p < 0.0001$), as from 2885, 2816, 2733 and 2713 dairy animals 69 (2.39%), 83 (2.95%), 20 (0.73%) and 6 (0.22%) for the DIM groups 1st, 2nd, 3rd and 4th, respectively suffered from puerperal metritis. From these results it was clearly, that the highest puerperal metritis problem was attained at the 2nd DIM group followed by the 1st one (<5 days postpartum). The lowest puerperal metritis affection recorded within the 3rd and 4th DIM groups (0.69% and 0.21%, respectively).

From the same table results the proportion of attack females to their total was determined, as the dairy Holstein cows in the 2nd DIM group (5-10 days postpartum) possessed the highest percentage of puerperal metritis prevalence 46.4 %, followed with those of the 1st DIM group (<5 days postpartum) which had the percentage of 38.5% among metritis attacked cases. On the other hand, the lowest prevalence was attained in the 3rd (10-15 days postpartum) and 4th (<15 days postpartum) DIM groups (11.2% and 3.4%, respectively). The overall percentage of puerperal prevalence of the first two DIM groups recorded 84.9% of puerperal metritic cases. Both the 1st and 2nd DIM groups sustained 5.27% from the total herd percentage, as 84.9%

of the puerperal metritic females were located within. From foregoing results it was clearly that 5.72% of the dairy cows affected with puerperal metritis during the first 10 days in early postpartum, that about 84.9% of the affected cows attacked with metritis during this period.

3.4. Effect of Calving Season on Puerperal Metritis Prevalence among Dairy Holstein Cows

Dairy cattle calving season reflects greatly on the prevalence of puerperal metritis **Table 4**. These phenomena expressed via chi square test (chi square value $\chi^2 = 19.41^{****}$) at ($p < 0.0001$). Spring calving cows had the highest puerperal metritis prevalence 22 (10.33%) followed with those which calved during summer season 65 (8.42%). While, the lower puerperal metritis prevalence obtained in winter 35 (4.65%) and fall 56 (4.88%) calving cows.

3.5. Frequency of Puerperal Metritis Prevalence and Culling Rates among Dairy Holstein Cows

The recurrence of puerperal metritis prevalence was determined among dairy females for 3 successive lactation seasons **Table 5**. The puerperal metritis attack tended to be recurrent in some dairy females. This trend expressed via chi square test (Chi square $\chi^2 = 243.27^{****}$) at ($p < 0.0001$). As, Dairy females were affected with puerperal metritis for once, twice and triple times with the prevalence of 5.55%; 0.53% and 0.11%, respectively. Same trend appeared when these metritic females compared with their total that 89.89 % of these females affected with metritis during their puerperium for once. Dairy cows could be re-attacked with metritis in their next puerperal phase by 8.43%. Also, the chance of puerperal metritis third attack would remain in dairy cows which had a history of metritis by 1.69%.

Regarding to the dairy cows culling due to metritis attack **Table 6** it was clearly, that the frequency of puerperal metritis attack possesses a significant effect on the puerperal metritis culling percentage in high yielding dairy Holsteins. This expressed via chi square test (chi square value $\chi^2 = 9.52^{***}$) at ($p < 0.001$). Same table expressed that the percentage of culling was increased with the increase of puerperal metritis frequency of attack. This trend appeared clearly, that out of 160; 15 and 3 puerperal metritic females 48 (30%); 8 (53.33%) and 3 (100%) females were culled for once, twice, triple attack, respectively. The highest culling percentage was recorded within the 3rd group (triple frequency of puerperal metritis attack), while the lowest attained within the 1st group (puerperal metritis attack for once).

Table 1. Effect of uterine status of the examined Holstein dairy cows on their milk

Uterine status	305 milk yield		Actual milk yield	
	Mean ± SE		Mean ± SE	
Puerperal metritis	9461.58±292.45		11833.04±452.57	
Normal	10087.17±74.66**		12015.67±174.66**	

* means of uterine status groups differed significantly at (p<0.05)

** means of uterine status groups different significantly at (P<0.01)

Table 2. Effect of puerperal metritis occurrence on the reproductive performance of Holstein dairy cows

Uterine status	Days to first estrus	Days open	Service per conception
	Mean ± SE	Mean ± SE	Mean ± SE
Puerperal metritis	77.60±4.09*	158.49±4.85**	2.77±0.10*
Normal	48.00±4.19	91.17±7.78	1.88±0.27

* means of uterine status groups differed significantly at (p<0.05)

** means of uterine status groups different significantly at (P<0.01)

Table 3. Effect of DIM on puerperal metritis occurrence among dairy Holstein cows

Group	DIM (days)	Total number	Puerperal metritis		Proportion to puerperal metritis cases (%)
			Number	%	
1	<5	2885	69	2.39	38.5
2	5-10	2816	83	2.95	46.4
3	10-15	2733	20	0.73	11.2
4	>15	2727	6	0.22	3.4

Chi square $\chi^2 = 89.98^{****}$ p<0.0001

Table 4. Effect of calving season on puerperal metritis occurrence among Holstein dairy cows

Calving season	Total number	Puerperal metritis	
		Number	%
Winter	752	35	4.65
Spring	213	22	10.33
Summer	772	65	8.42
Fall	1148	56	4.88

Chi square $\chi^2 = 19.41^{****}$ p<0.0001

Table 5. Frequency of puerperal metritis prevalence among dairy Holstein cows

Group	Puerperal metritis prevalence	Number of total herd	Puerperal metritis cows		Proportion to puerperal metritis cases
			Number	%	
1	Once	2885	160	5.55	89.89
2	Twice	2837	15	0.53	8.43
3	Triple	2829	3	0.11	1.69

Chi square $\chi^2 = 243.27^{****}$ p<0.0001

Table 6. Effect of frequency of puerperal metritis occurrence on the culling percentage in Holstein dairy cows

Group	Puerperal metritis prevalence	Total affected cases	Puerperal metritis culled cows	
			Number	%
1	Once	160	48	30.00
2	Twice	15	8	53.33
3	Triple	3	3	100.00

Chi square $\chi^2 = 9.52^{****}$ p<0.001

Table 7. Fate of dairy Holstein cows affected with puerperal metritis

Group	Puerperal metritis prevalence	Number of puerperal metritis	Number of total her	Returned to herd		Culled from herd	
				Number	%	Number	%
1	Once	160	2885	112.00	3.88	48.00	1.66
2	Twice	15	2837	7.00	0.25	8.00	0.28
3	Triple	3	2829	0.00	0.00	3.00	0.11
Total	178	2885	119	4.13	59.00	2.05	

3.6. Fate of Dairy Holstein Cows Affected With Puerperal Metritis

An interesting finding of our study is that the fate of the dairy cows is associated with the puerperal metritis prevalence for once or several times **Table 7**. The results referred to the total puerperal metritis within the high yielding dairy Holstein herd reached to 6.17% within the period of three successive lactation seasons. Moreover, about 4.13% of the affected cases return to the dairy herd, while the rest were culled 2.05%. Culling and remaining of the dairy cows from the dairy herds were depending on the disease history of puerperal metritis attack, as the culling percentages were 1.66%; 0.28% and 0.11% for once, twice and triple puerperal metritis attack, respectively. While, the remaining within the dairy herd percentages were 3.88%; 0.25 and 0% for once, twice and triple attack of puerperal metritis, respectively.

4. DISCUSSION

4.1. Effect of Puerperal Metritis Prevalence on Dairy Holstein Cows Productive Performance

Lactating dairy cows are susceptible to numerous infectious and metabolic diseases during the early postpartum period. Puerperal metritis, or early metritis, is a postpartum disease known to reduce milk yield (Rajala and Grohn, 1998) and feed intake (Huzzey *et al.*, 2007) and to negatively affect reproductive performance (Melendez *et al.*, 2004).

Similarly to the results obtained by others (Fourichon *et al.*, 1999; Deluyker *et al.*, 1991; Rajala and Grohn, 1998; Huzzey *et al.*, 2007; Proudfoot *et al.*, 2009), the present study showed a decrease in the milk production (305 and actual yields) in the puerperal affected dairy cows than healthy ones. The results could be attributed to decrease of the feed intake during the course of the disease in addition to the inflammatory toxins which caused illness signs (depression, weakness, fever >39.5°C and loss of appetite). Huzzey *et al.*, 2007;

Proudfoot *et al.*, 2009 reported that, cows with metritis had a low feed intake. The reduction in feed intake in the first 21 days in lactation explained the lower daily milk yield observed in such cases over the first 20 weeks of lactation.

Fourichon *et al.* (1999; Deluyker *et al.*, 1991) reported that metritic dairy cows within the first 21 lactation day's loss about 4.9 pounds per day from their average milk yield during the first 120 days postpartum compared to normal herdmate. While, Rajala and Grohn (1998) proofed that, dairy cows which had a puerperal metritis loss 6 pounds of their milk yield each day, but only for a period of about 2 weeks for the disease course. In contrast, other researches indicate that affection of the dairy cows during early lactation had an overall negative impact on the milk production in multiparous cows, as these animals produced less milk than those which remained healthy. This milk yield reduction was experienced not only during the metritis attack but also throughout the first 20 weeks of lactation, even though all sick cows received veterinary treatments (Huzzey *et al.*, 2007; Proudfoot *et al.*, 2009).

From the outgoing results it was evident that puerperal metritis considered as a huge economic loss, as it could be produced about 2371.46 kg milk yield loss per each dairy Holstein cow on 305 days milk yield bases. While, on the actual dairy milk bases this milk loss tended to somewhat decreased to 1928.5 kg per each dairy cow. The results could be attributed to metritic cows had much longer days open period than normal ones, thus increased their actual lactation length than normal cows. So, the average of actual milk yield loss in such affected cows somewhat lowered than the average of 305 milk yield loss.

4.2. Effect of Puerperal Metritis Prevalence on Dairy Holstein Cows Reproductive Performance

Good reproductive efficiency is an important factor for production economy in a dairy herd. Metritis is one of the most common cattle diseases that can be a significant cause of poor reproduction (Overton *et al.*, 2003; Wittrock *et al.*, 2011), even though some investigations

show a rather limited effect (Markusfeld and Ezra, 1993). Current study also clearly show that the reproductive performance possessed significant difference among different uterine statuses in dairy Holstein cows.

The present study evident that the puerperal metritis affected the dairy cows reproduction so badly. These results agreed with (Overton and Fetrow, 2008; Galvão *et al.*, 2009a; 2009b). Metritis causes a depression in dairy cattle fertility, as it increased the days open value by 18 days and a declined the 21-day pregnancy rate by 3-6% (Overton and Fetrow, 2008). Most of the negative effects of puerperal metritis were due to extend of dairy cows days open, as it increased the days open by about 13-28 days (Fourichon *et al.*, 2000). Uterine diseases (puerperal metritis, clinical metritis, clinical endometritis and subclinical endometritis) have been associated with increased service preconception, extended days open, increased culling and economic losses (Gilbert *et al.*, 2005; Overton and Fetrow, 2008; Galvão *et al.*, 2009a; 2009b).

Metritic dairy cows had very high days open value than normal ones, which were differed from each other with high significant value at ($P < 0.01$). These phenomena could be much more costly for the high yielding dairy farming. The dairy investments spent much more money in treatment of such diseased cases in addition to the dairy cows loss many chances to be pregnant. This problem may lead to extra service costs, which appeared clearly in the number of services per conception results. As, the metritic dairy Holstein consumed about (2.77) semen straw to be pregnant, thus could be costly for the dairy Holstein farms. Dairy producers spent a lot of money in parching of high genetic merit semen straws with its higher prices. In contrast, normal dairy cows in high yielding Holstein dairy farms remained the number of semen straws used for insemination per each dairy cow much lower (1.88) than metritic ones. However, this figure may be increased somewhat than the normal value of dairy Holsteins (1.7). Thus, may be due to the stress of high milk yield in such cows. The high milk yield affected the dairy cow's reproduction so badly (Leroy and De-Kruif, 2006). These results were in agreement with those of (Fourichon *et al.*, 2000; Gilbert *et al.*, 2005; Overton and Fetrow, 2008; Galvão *et al.*, 2009a; 2009b), as they reported that metritis had a great negative impacts on reproduction, as it decreased pregnancy rate, extended open period, increased culling rate and economic losses.

Fourichon *et al.* (2000) stated that, the main effect of the puerperal metritis on the dairy cattle reproduction was days open, as it could be increase by 13-28 days above its normal value in puerperal metritic females. The negative

effects of the puerperal metritis upon fertility were due to the negative effects on the uterine wall and ovary. As, the dairy cattle puerperal metritis caused lesions on the endometrium (Bonnett *et al.*, 1991), these lesions disrupt endometrial function (Sheldon and Dobson, 2004) and impair embryo development (Hill and Gilbert, 2008).

4.3. Effect of Days in Milk (DIM) on Puerperal Metritis Prevalence among Dairy Holstein Cows

Across days in milk the highest puerperal metritis prevalence recorded during the first 10 days postpartum. These results were somewhat lower than those of (Huzzey *et al.*, 2007; Galvão *et al.*, 2009b), as they reported that the incidence of metritis in the dairy herds was 20% with the range of 8 to >40% in some dairy herds. Thus, may be attributed to the prevalence of metritis in this study was estimated during shorter postpartum period (21 days postpartum).

4.4. Effect of Calving Season on Puerperal Metritis Prevalence among Dairy Holstein Cows

The prevalence of puerperal metritis increased significantly during the spring and summer calving seasons. These results could be due to the magnitude of the postpartum immune suppression during warm months which may result from excessive heat stress, as most of these periods had a high temperature degree under Egyptian atmospheric conditions. The results agreed with (Dolezel *et al.*, 2008) and disagreed with (Benzaquen *et al.*, 2007), as they reported that the incidence of the puerperal metritis in primiparous cows increased in warm seasons than cool seasons, while these phenomena were disappeared in multiparous cows. In contrast, Dolezel *et al.* (2008) found that the incidence of the puerperal metritis was increased during the spring calving season.

4.5. Frequency of Puerperal Metritis Prevalence and Culling Rates among Dairy Holstein Cows

The puerperal metritis attack in high yielding Holsteins may have the tendency to be recurrent. The culling percentage increased with the increase of frequency of dairy cattle attack. These results could be due to the cumulative effect of the puerperal metritis attack on dairy cattle production and reproductive parameters, as by the time the re-attack with metritis promoted its bad effects on dairy performance. Dolezel *et al.* (2008) recorded that the puerperal metritis depressed high yielding dairy cows first serving pregnancy, increased

days open, service pre-conception and calving intervals. This explained the high culling rates of dairy cows attacked with metritis for second and third times.

The results referred to dairy cows which attacked with puerperal metritis for twice had high culling percent as the culling percentage of such cows reached over the half of their percentage (53.33 %). While, the triple metritis attack prevents dairy cows from standing within dairy herd, as the culling percentage in such condition be 100%. These results go in parallel with those of (Huzzey *et al.*, 2007; Proudfoot *et al.*, 2009), who reported that about 50% of multiparous cows whom suffered from metritis were culled from the dairy herds within the first 60 days in lactation.

4.6. Fate of Dairy Holstein Cows Affected With Puerperal Metritis

This study reported that the probability of the dairy cows to return to their dairy herd after puerperal metritis attack is somewhat limited, while the culling probability is much higher. These results were in agreement with those of (Huzzey *et al.*, 2007; Proudfoot *et al.*, 2009), who reported that the half of metritic multiparous cows were culled from their herds within early 60 days of lactation.

The results disagreed with (Overton and Fetrow, 2008), who reported that dairy cows affected with metritis have an increased culling risk of 5.3% during the first 60 days in milk. Also, the culling risk could be reached to 14% after the first 60 days in milk and the breeding period.

5. CONCLUSION

Puerperal metritis had great negative impacts upon high yielding Holstein cows productive and reproductive performance even after efficient treatment, as it could be decreased the milk yield by about 2371.46 kg per season on 305 milk yield bases. Also, it increased days to first estrus, days open and number of services per conception. Moreover, concern must be given to the dairy females, which calving during spring and summer seasons, as these seasons have high prevalence of puerperal metritis.

Dairy producers must be focusing their efforts to detect puerperal metritis within the first ten days of the postpartum period. Since most of such cases appeared during this period by a rate of 89.98%. Attention should be taken to reappearance of the puerperal metritis during successive lactation seasons in the dairy females whom had a history of puerperal metritis as this disease had tended to be recurrent. Moreover, the re-attack of

puerperal metritis during the second and third successive lactation season, preventing the dairy cows from withstanding in dairy herds, as the culling percentage was 53.33 and 100%, respectively for such diseased females. Further researches in the near future must be directed to prevention of puerperal metritis, as most of effective treatments don't prevent the negative impacts of such disease upon dairy, reproduction and culling percentage within dairy herd.

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