

Risks of Some Postpartum Uterine Affection on Reproduction and Milk Yield of High Yielding Dairy Cows

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Abstract

The objective of this study was to quantify the effect of some postpartum uterine affection on productive and reproductive performance of high yielding Holstein cows. Productive, reproductive and uterine affections data were obtained from high yielding Holstein herd within private dairy enterprise. Throughout the studying about 705 dairy records were enrolled in a randomized trial. Data of BCS, parity, calving season, milk yield (initial, peak, and 305 milk yields) and reproductive parameters (days to first estrus, days open, service per conception, intervals between heats, calving interval and pregnancy rate at 100 post last insemination) were obtained from on-farm record system (DairyComp 305). Retained placenta, puerperal metritis and mixed cases (retained placenta and puerperal metritis) were diagnosed by herd veterinarians. The treatments of such affected cases were done according to standards of herd treatment strategy. Dairy cow were grouped according to their uterine affection into 4 groups, as puerperal metritis, retained placenta, mixed cases and healthy.

The results of this study revealed that: Early postpartum uterine problems affect dairy cattle productive and reproductive performance so badly, as puerperal metritis and retained placenta had worst effects on milk production and these bad effects maximized when the retained placenta developed together with metritis within the same case. Dairy cattle reproduction goes in the same way of production as the reproduction affected badly with puerperal metritis, retained placenta, and mixed cases. Early postpartum uterine affection increased days to first estrus, days open, service per conception, calving interval, and decreased pregnancy rate in the first 100 DIM.

Keywords: Postpartum uterine affections; Puerperal metritis; Retained placenta; Body condition score; Dairy cows; Parity; Holstein friesian

Abbreviations: BCS: Body Condition Score; DIM: Days in Milk; Kg: Kilogram; D: Day

Introduction

Nowadays, the average milk yield was gone over 9000 kg per season in many dairy Holstein herds. This huge increase in milk production was attained from aggressive genetic selection and improving of dairy cows over generations, in other words it is the magic of the modern science. However, this increase was not achieved without any costs that when the dairy farmers are currently asked about the principal health hazards which will face their business in the near future, they mention subfertility [1]. Subfertility is known to be multifactorial problem and to a large extends depend on the management practices. The main causes of the subfertility including longer days to first service and days open among the dairy herds were retained placenta and metritis [2]. High yielding dairy cows suffered more from retained placenta and metritis than others [1], this fact complicate any production strategy in high yielding dairy farms.

Retained placenta considered as the third most common health hazard in dairy cows [3]. It is defined as the retention of the fetal membrane for more than 24 hour postpartum [4]. The retention of the fetal membrane in cattle could be lead to adverse health events such as pyometra, metritis, ketosis and mastitis [4,5].

Puerperal metritis is a health hazard affecting dairy cows within the first 21 days in milk (DIM) which associated with abnormal enlarged uterus, red brown uterine discharges, dullness, decrease of

milk production and fever over 39.5°C. These symptoms were not fixed as some affected cases exhibit no systemic signs except abnormally enlarged uterus with a purulent uterine discharge detectable in the vagina within the 3 successive weeks postpartum [6]. The metritis and endometritis represent important causes of (sub) infertility in cows. The negative effect of these affections on reproductive performance in dairy herds has been sufficiently evidenced [7,8]. The objective of concurrent work was to quantify the effect of metritis, retained placenta, and mixed affections on reproductive performance and milk yield of high yielding Holstein cows.

Materials and Methods

The study was done within the period from February 2014 to April 2015. The study was done in private high yielding Holstein herd (average milk yield=9000 kg/season) located in Giza governorate, Egypt. Throughout the studying 705 dairy record were collected from the above mentioned dairy herd. Data of BCS, parity, calving season, milk yield (initial, peak, and 305 milk yields) and reproductive parameters (days to first estrus, days open, service per conception,

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intervals between heats, calving interval and pregnancy rate at 100 post last insemination) were determined from the dairy records.

Different uterine affection metritis, retained placenta, and mixed form of the two affections (metritis with retained placenta) were determined using the dairy farm health record. The diagnosis of the metritis and retained placenta done via farm veterinarians using standardized definitions. The retained placenta case was defined as the retention of the fetal membrane within the dairy animal over 24 hours [4], where puerperal metritis case is the inflammation of uterine layers with enlarged uterus in the first 21 days after parturition together with the decrease of milk production, general toxemia, red brown fetid uterine discharge and fever up to 39.5°C [6]. The treatments of such affected cases were done according to standards of herd treatment strategy. After full identification of all data, the dairy cows were grouped according to their status of uterine affection into four groups as puerperal metritic, retained placenta, mixed cases (cases which exhibited both retained placenta and metritis) and healthy.

Statistical analysis

The herd data were collected and obtained from the on-farm record system (DairyComp 305) then enrolled to further statistical analysis with SPSS analytical software [7-9].

Results

Ratios of postpartum uterine affection among different BCS, lactation parity, calving season, primiparous and pleuriparous Holstein cow groups

Ratios of different uterine affection vary among dairy cattle with regards to BCS, parity and calving season (Table 1). It was clearly that the prevalence ratio of puerperal metritis increased in the dairy cows of medium BCS (3-4 BCS) as it reached to (3.41%) and in old dairy cows which had parity numbers over 5 that it reached to (7.89%). Puerperal metritis ratio increased during warm calving season, as either summer or spring calving seasons had high metritis ratios (3.76%, and 3.88%, respectively). Moreover, the ratio of the puerperal metritis attack increased in pleuriparous cows (2.02%) vs primiparous ones (3.30%).

Retained placenta affection didn't passed with the same way of

metritis, as the retained placenta increased in fatty cows which had BCS value over 4, that these cows have retained placenta prevalence ratio of (2.10%). In contrast to metritis prevalence results the retained placenta prevalence ratio increased within the primiparous cows (3.03%) vs. the pleuriparous ones (1.32%). The prevalence of the retained placenta increased during the winter calving season as it reached to (2.27%), as this ratio was much higher than any other calving season.

As interesting results of the current study is the prevalence of mixed cases among the high yielding dairy females, as the mixed cases prevalence ratio increased in the fatty cows (1.40%) than both medium (0.90%) and poor (0.00%) condition ones. Moreover, the prevalence of such cases increased in either young cow which had one lactation parity (2.02%) or old cows which had over 5 lactation parities (2.63%). Furthermore the spring calving season had the highest mixed cases prevalence (1.29%) compared with different calving seasons. Also, primiparous cows had a great chance to develop the mixed cases than other dairy cows as the prevalence ratio of the mixed cases reached to (2.02%) compared with other pleuriparous cows which had much lowered prevalence ratio (0.83%).

Effect of postpartum uterine status on dairy cattle productive performance

Concerning to the effect of puerperal uterine affections on the dairy cattle productive performance (Table 2) explained that the dairy cows which affected with either metritis and retained placenta had low initial milk yield (24.40 ± 3.29, and 21.75 ± 1.68 kg, respectively) than healthy ones (31.59 ± 0.33 kg) at (P<0.05). Moreover, the same trend appeared with 305 milk yield results, as the dairy cows which affected by metritis developed from retained placenta had the lower 305 milk yield value (8118.89 ± 36.58 kg) followed by those which affected with retained placenta (8790.71 ± 34.86 kg), while the highest value of 305 milk production was attained in the healthy group (9485.71 ± 186.06 kg) at (P<0.05). Moreover, puerperal metritis cows had low milk yield value (9334.58 ± 42.38 kg) than healthy ones (9485.71 ± 186.06 kg), but this decrease was not reached to the significance level at (P>0.05).

Puerperal metritis as a dairy cattle uterine affection can cause milk production loss by about 151.13 kg, while retained placenta caused 695 kg loss on 305 milk yield bases. The maximum milk production loss

Parameters	Total	Puerperal uterine affection								
		Metritis		Retained placenta		Mixed		Healthy		
		No	%	No	%	No	%	No	%	
BCS	Poor (<3)	5	0	0.00	0	0.00	0	0.00	5	100.0
	Medium (3-4)	557	19	3.41	8	1.44	5	0.90	525	94.25
	Fatty (>4)	143	3	2.10	3	2.10	2	1.40	135	94.41
Lactation parity	1	99	2	2.02	3	3.03	2	2.02	92	92.93
	2	322	7	2.17	6	1.86	3	0.93	306	95.03
	3	112	6	5.36	0	0.00	0	0.00	106	94.64
	4	78	2	2.56	2	2.56	1	1.28	73	93.59
	5	56	2	3.57	0	0.00	0	0.00	54	96.43
	>5	38	3	7.89	0	0.00	1	2.63	34	89.47
Season	Summer	213	8	3.76	4	1.88	2	0.94	199	93.43
	Fall	128	2	1.56	1	0.78	1	0.78	124	96.88
	Winter	132	3	2.27	3	2.27	1	0.76	125	94.70
	Spring	232	9	3.88	3	1.29	3	1.29	217	93.53
Primi/pleuri	primiparous	99	2	2.02	3	3.03	2	2.02	92	92.93
	pleuriparous	606	20	3.30	8	1.32	5	0.83	573	94.55

Table 1: Ratios and percentage of postpartum uterine affection among different BCS, lactation parity, calving season, primiparous and pleuriparous Holstein cow groups.

Uterine status	Initial milk yield (kg)	Peak milk yield (kg)	305 milk yield (kg)
	Mean ± SE	Mean ± SE	Mean ± SE
Metritis	24.40 ± 3.29 ^{bc}	35.60 ± 4.05 ^a	9334.58 ± 42.38 ^a
Retained placenta	21.75 ± 1.68 ^c	36.25 ± 2.09 ^a	8790.71 ± 34.86 ^b
Mixed cases	28.40 ± 1.33 ^{ab}	36.33 ± 2.37 ^a	8118.89 ± 36.58 ^c
Healthy	31.59 ± 0.33 ^a	41.86 ± 0.33 ^a	9485.71 ± 186.06 ^a

Table 2: Effect of postpartum uterine affection on dairy cattle productive performance [initial, peak, and total 305 milk yield (kg)].

Uterine status	Days to first estrus (days)	Days open (days)
	Mean ± SE	Mean ± SE
Metritis	46.08 ± 3.00 ^c	106.24 ± 1.04 ^{ab}
Retained placenta	37.00 ± 2.54 ^c	107.25 ± 3.85 ^{ab}
Mixed cases	62.67 ± 1.56 ^a	115.33 ± 5.36 ^a
Healthy	56.13 ± 1.19 ^b	91.00 ± 3.87 ^b

Table 3: Effect of postpartum uterine status on dairy cattle reproductive performance [days to first estrus, and days open (days)].

appeared clearly in the mixed cases as these cases had a decreased in their milk yield value by 1366.82 kg of milk than normal ones.

Effect of postpartum uterine status on dairy cattle reproductive performance

Dairy cattle reproduction was significantly possessed differences among postpartum uterine problems (Table 3), that the mixed cases exhibited the highest days to first estrus value (62.67 ± 1.56 d), while the lowest one was attained in the retained placenta group (37.00 ± 2.54 d). Also, either puerperal metritis (46.08 ± 3.00 d) or retained placenta (37.00 ± 2.54 d) had low days to first estrus and didn't significantly differed from each other at (P>0.05). Moreover, the highest days open value was attained in mixed cases group (115.33 ± 5.36 d), while the lowest result was recorded in the healthy group (91.00 ± 3.87 d) at (P<0.05).

Referring to the effect of the puerperal uterine affection on service per conception, the service per conception values were significantly differed among different dairy cattle uterine statuses during the early postpartum stage (Table 4). It was evident that, the highest service per conception value was attained in the dairy cows which suffered from both metritis and retained placenta (mixed cases) (4.33 ± 0.75), while the lowest value was attained in the healthy group (1.46 ± 0.12) at (P<0.05). Moreover, both metritis and retained placenta groups had higher service per conception values (2.81 ± 0.05, and 2.00 ± 0.21, respectively) than healthy ones at (P<0.05). Furthermore, the two later groups decreased the service per conception values than the mixed cases group at (P<0.05).

From the same table it was evident that, postpartum uterine problems affected dairy cattle estrus cycle badly. The puerperal metritis decreased the intervals between heats, as the metritis group attained the lowest heat interval period (10.00 ± 1.70 days) among different puerperal uterine affection (P<0.05). Moreover, either retained placenta and mixed groups attained higher calving interval periods (390.25 ± 3.85, and 394.33 ± 10.66) than normal healthy cows (356.35 ± 1.29) at (P<0.05).

The first serving pregnancy ratio possessed no significant difference among different tested postpartum uterine affections (Table 4). These phenomena expressed via chi square test (chi square value $\chi^2=8.26$) at (P>0.05). This means that the differences between postpartum uterine status groups in dairy cattle didn't reached to the significance level.

Regarding to the effect of postpartum uterine affection on pregnancy at first 100 days (Table 5), it was clearly that the postpartum uterine problems affected significantly the pregnancy rate at the first 100 days (Table 6). This phenomena expressed via chi square test (chi square value $\chi^2=13.26^{**}$) at (P<0.05). As, out of 22 metritis cases 7 (31.82%) cases get in pregnancy and 15 (68.18%) weren't pregnant. This percentage values tended to be decreased in the retained placenta group as from 11 affected females only 6 (54.55%) females become pregnant while the rest were not pregnant 5 (45.45%). Moreover, the dairy females which suffered from mixed cases had lowest pregnancy chance, as out of 7 affected Holsteins 2 (28.57%) cases become pregnant, while the rest 5 (71.43%) cases weren't pregnant. In contrast, the higher pregnancy rate at the first 100 days was attained in the healthy group, that from 665 healthy cases 426 (64.06%) case go in pregnancy while about 239 (35.94%) were not pregnant.

Discussion

Ratios of postpartum uterine affection among different BCS, lactation parity, calving season, primiparous and pleuriparous Holstein cow groups

Postpartum Uterine disease affects half of all dairy cattle after parturition, causing infertility by disrupting uterine and ovarian function. Prevalence of these early uterine affections varies from area to area, from a herd to another, and the diagnostic methods. The higher level of metritis among dairy cows appeared in old dairy cows which have medium body condition score value (3-4 point). Also the higher prevalence of metritis appeared during the spring and summer seasons. Thus may indicate that the hot humid atmosphere during the worm months could be considered as the most favor predisposing factor for puerperal metritis attack. From another side retained placenta affection

Uterine status	Service per conception	Intervals between heats (days)	Calving intervals (days)
	Mean ± SE	Mean ± SE	Mean ± SE
Metritis	2.81 ± 0.05 ^b	10.00 ± 1.70 ^b	367.93 ± 4.67 ^{ab}
Retained placenta	2.00 ± 0.21 ^b	24.63 ± 0.61 ^a	390.25 ± 3.85 ^a
Mixed cases	4.33 ± 0.75 ^a	22.60 ± 0.34 ^a	394.33 ± 10.66 ^a
Healthy	1.46 ± 0.12 ^c	18.56 ± 0.52 ^a	356.35 ± 1.29 ^{bc}

Table 4: Effect of postpartum uterine status on dairy cattle reproductive performance [service per conception, intervals between heats, and calving intervals (days)].

Puerperal uterine affection	Total=705	Pregnant		Non pregnant	
		No	%	No	%
Metritis	13	4	30.77	9	69.23
Retained placenta	9	5	55.56	4	44.44
Mixed	6	2	33.33	4	66.67
Healthy	436	279	63.99	157	36.01
Chi square $\chi^2=8.26$		P<0.05			

Table 5: Effect of postpartum uterine status on first service conception rate.

Puerperal uterine affection	Total =705	Pregnant		Non pregnant	
		No	%	No	%
Metritis	22	7	31.82	15	68.18
Retained placenta	11	6	54.55	5	45.45
Mixed	7	2	28.57	5	71.43
Healthy	665	426	64.06	239	35.94
Chi square $\chi^2=13.26^{**}$		P<0.001			

Table 6: Effect of postpartum uterine status on pregnancy rate at the first 100 days.

increase in the fatty dairy cows. These results go in parallel with those of Deyab, Gabr et al., Gaafar et al. [10-12].

Gaafar et al reported that, the incidence of the retained placenta increased with increasing of the fat tissue deposition and cow's body weight [12]. The high retained placenta incidence within the fatty cows could be due to could be trapped the steroid sex hormones via excessive fat deposition, as these hormones are known to be fat soluble hormones.

The prevalence of the retained placenta is much higher in the primiparous cows during their first lactation parity. This result were in disagreement with those of Karen, Deyab, Gabr et al., Gaafar et al. [10-13], as they reported that the incidence of retained placenta increased by the increase of dairy cows age. The current study results indicate that the increasing of retained placenta prevalence attain in the winter calving season. This result disagreed with those of Deyab, Gabr et al, Gaafar et al. [10-12], as they reported that the incidence of the retained placenta increased during summer and spring calving seasons.

Effect of postpartum uterine status on dairy cattle productive performance

The depression of the productive parameters in different uterine affection within this study could be due to the toxic effects of such diseases on different body tissues which had both direct effect on the udder tissue and indirect effect on other body tissues and this affected the dairy production badly. The maximum productive losses were appeared clearly in the results of mixed cases, thus could be due to the additive effect of both retained placenta and puerperal metritis in mixed cases. The results go in parallel with those of Rajala and Grohn, Dubuc et al. [5,14] as they reported that retained placenta, early postpartum metritis and dystocia affected the dairy milk yield badly.

Dubuc et al. reported that postpartum metritis and retained placenta decreased the milk production in pleuriparous cows by (3.7 and 2.6 kg, respectively) on daily bases [5]. The projected effects of metritis and retained placenta in pleuriparous cows decreased the milk production by 259 kg and 753 kg on 305 milk yield bases.

Effect of postpartum uterine status on dairy cattle reproductive performance

The results of decreasing of days to first estrus in the puerperal metritis and retained placenta cases were in contrast of those of Overton and Fetrow, Galvão et al (a,b) [15-17] as they reported that metritic dairy females had longer days to first estrus than other ones.

The high days to first estrus and days open values in the mixed cases could be due to the additive effect of the two reproductive hazards on endometrial epithelium which inhibits ovarian cyclicity. The results agreed with Shiferaw et al, Overton and Fetrow, Sheldon, Galvão et al (a,b) [15-19] as they reported that the fertility problems which associated with the uterine affection could be caused by damage to endometrium and interruption of ovarian cyclist. Microorganisms could alter the endometrial prostaglandin secretion and interrupt the ovarian follicular growth.

Shiferaw et al. as they proofed that the cows which affect with retained placenta had longer days from calving to first estrus [18]. Overton and Fetrow stated that metritis had a great effect upon dairy cattle fertility as it could be extended the days open value by about 18 days [15]. From another point of view Fourichon et al. reported that the main negative effect of metritis on dairy cattle fertility is extending the days open value by about 13-28 days [19,20]. Furthermore, Han

and Kim, Gaafar et al. reported that the dairy cows which had retained placenta had long days to serving than normal one [2,12].

The high services per conception values in the puerperal metritis, retained placenta, and mixed cases results go in parallel with those of Gilbert et al., Overton and Fetrow, Galvão et al. (a,b) [7,15-17] as they stated that uterine diseases associated with increasing of the service per conception, days open, culling rates and economic losses. Shiferaw et al., Han and Kim, Gaafar et al. [2,12,18] proofed that, the dairy cows which retained placenta affection had large number of service per conception than normal ones.

The uterine affected cases have high calving interval than normal ones this could be due to extend days to first estrus and days open in such cases. These results were in agreement with those of Han and Kim, Gaafar et al. as they reported that the dairy cows which affected with retained placenta had longer calving intervals [2,12].

The differences between postpartum uterine statuses groups in dairy cattle didn't reached to the significance level in the first service conception rate. These results were in disagreement with those of Echterkamp et al., Shiferaw et al, Gaafar et al., Dubuc et al. who reported that a reduction of the conception rate of cows exhibiting retained placenta particularly compared to normally calved ones [12,18,21,22]. The differences between this study and previous results could be attributed to the difference in estimation of the conception rate, as in the present study the conception rate depending on the first serving only, while the past studies depending on all serving numbers. The results could be attributed to small difference between normal healthy cows and affected ones in the first serving conception ratio as most of healthy cows weren't conceive from the first service as the conception ratio at least reached to 1.5 services per each normal cow.

The best pregnancy rat at the first 100 days was attained in the healthy group followed by the retained placenta group, metritis group and finally with the mixed cases one. These results could be due to the cumulative effects of these affections on the uterine health and conjunction between retained placenta and metritis which is formed their complex effect.

Different dairy cattle uterine affection decreased the pregnancy at the first 100 days thus may be due to bad effects of such affection upon endometrium which may inhibit implantation of newly formed embryos or affect the sperm life. The results gone in parallel with those of Dubuc et al as they proofed that different uterine diseases decreased pregnancy rate, which was considered as a great risk factor for culling. However, if these affected cows became pregnant they will stay in their dairy herd [22-25].

Conclusion

Postpartum uterine problems had great impacts on the productive and reproductive performance of high yielding dairy cows. Either puerperal metritis or retained placenta had a negative impacts on milk production in the high producers add on and above their negative impacts tended to be maximized if the two affection occurring together within the same cow. High lactating dairy cows suffered from postpartum uterine affection had very bad reproductive performance, as the cows affected by both metritis, retained placenta and/or the mixed conditions increased the days to first estrus, days open, serving per conception, calving interval, and decreased pregnancy rate at the first 100 days in milk.

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