

Influence of Calving Season and Ambient Temperature on Anestrus Post Calving in Imported Holstein-Friesian Cows in Temperat Environment

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Abstract: The objective of the present study was to determine the relationship between the incidence of anestrus post calving cows and the ambient temperature, months and calving seasons. This study was carried out on an imported dairy herd. The herd comprises of Holstein, Friesian crossbreeds. The results of the study indicated that a total percentage 49.36% of the cows suffering from delayed reestablishment of estrus till day 45 post calving while 33.19% were suffering from delayed estrus reestablishment till day 65 post calving. Meanwhile, the results of the study revealed an inverse relationship between the ambient temperature and the percentage of cows that showed a delayed in re-establishment of post calving estrus. According to seasonal classification, a higher percentage (66.3 and 47.28%) of anestrus cows post calving till day 45 and 65 post calving subsequently were recorded during winter whereas lower percentage (22.77 and 1.98%) subsequently were recorded during summer. The result of clinical examination (rectal palpation of ovaries) of 241 cows failed to exhibit estrus symptoms revealed that 64.73% of these cows were with group inactive ovaries (without corpus luteum) whereas 35.27% of these cows were with active ovaries (with corpora lutea), this of cows is recognized as cows with silent and unobserved estrus, statistical analysis of the data indicated that there is no relationship between the unobserved estrus (or silent estrus) with the ambient temperature. The results also showed that high percentage of anestrus post calving cows with inactive ovaries were recorded during winter and autumn (73.11 and 71.78%) subsequently whereas high percentage of anestrus post calving cows with active ovaries were recorded during summer.

Key words: Anestrus post calving, ambient temperature, calving seasons, corpus luteum, silent estrus, Iraq

INTRODUCTION

Reproductive efficiency in dairy herds can be judged by measuring the calving interval to determine if the calving occurs within 12 months or less (McDougall and Rhodes, 1999; Rhodes *et al.*, 2003). In this regard, one of important factors leading to prolong calving interval in dairy herds is the anestrus post calving (Darwash *et al.*, 1997). Therefore, there is a general agreement that in dairy herds, cows should be exhibiting estrus symptoms before day 40 post calving and inseminations should be at days 42-60 post calving (Opsomer *et al.*, 2004). Hence in order to prevent economical losses in dairy industry, cows with long anestrus period after calving are considered to be problem cows and should be examined through regular herd health visits (Farin and Slenning, 2001). Several reports indicated that cows fail to exhibit estrus symptoms at the time of insemination could be due either to a lack of ovarian activity (true anestrus) or silent ovulation and unobserved estrus (Opsomer *et al.*, 2004). Cows with an

extended interval from calving to first ovulation have increased intervals from calving to conception and are more likely to be culled compared to cows with short intervals from calving to first ovulation (Opsomer *et al.*, 2000a). It is well documented that after regression of pregnancy corpus luteum, there is a variable anovulatory periods before first ovulation takes place (Peters and Ball, 1987). The length of these anovulatory periods can be affected by several factors such as level of nutrition, calving season, suckling, lactation, dystocia, uterine infection and chronic diseases (Rhodes *et al.*, 2003). Several researchers indicated that the season of year influences, the length of post calving anestrus in dairy cows especially in temperate and subtropical regions (Lamming *et al.*, 1981; Jonnson *et al.*, 1997; Opsomer *et al.*, 2000a). In this regard, heat stress, quantity and quality of nutritional management and photoperiod might play some role in resumption of post calving ovarian activity (Opsomer *et al.*, 2004). Silent heat (estrus) is defined as the lack of behavioral estrus symptoms although the genital organs undergo normal

cyclical changes (Opsomer *et al.*, 2000b). The incidence of silent estrus fluctuated from 10-40% between different herds (Opsomer *et al.*, 2004; Czyk *et al.*, 2005).

Most incidents of silent estrus are due to bad heat detection (Senger, 1994; Van Eerdenburg *et al.*, 1996), this also influenced by nutritional factors (energy deficiency, high intake of isoflavones), metabolic disorders (Czyk *et al.*, 2005), housing condition, milk yield (Opsomer *et al.*, 2004) and heat stress (De Rensis and Scaramuzzi, 2003). Bovine practitioner depends the presence of corpus luteum as the main criterion used to differentiate between anestrus due to ovarian abnormalities and anestrus due to lack of detected heat symptoms (silent heat) or unobserved estrus. For this purpose, several techniques have been used to diagnose the presence of corpus luteum including transrectal palpation of ovaries, progesterone assay and ultrasonography (Omran *et al.*, 1988; Pieterse *et al.*, 1990; Lamming and Darwash, 1998; Royal *et al.*, 2000). Although, the last two techniques are efficient and by using them in researches much progress has recently been made in uncovering the pathophysiology of the anestrus problem. But the transrectal palpation is still the most popular due to its cheapness, accuracy and easy to apply in field work to detect the presence of corpus luteum.

The aim of the present study is to investigate the influence of the ambient temperature and season on the post calving anestrus period in imported cross breed Holstein/Friesian dairy herds in Iraqi (temperate) climate.

MATERIALS AND METHODS

The current study was conducted at Al-Lattifiah dairy farm (20 km South of Baghdad, Iraq) which uses the open housing system. The farm comprises of cross Holstein/Friesian breeds. Cows used in this study have calved at least once with an age ranged from 3-6 years and individually identified with ear tag numbers. The herd had a history of normal fertility and characterized by good levels of milk yield and heavy feeding.

A total number of 470 calvings during one calendar year (January to December) were used in this study. The parturition of the used animals were normal and without any complications.

Clinical examinations: All cows were submitted for two routine clinical examinations from 3-15 days after calving in order to detect retained fetal membranes and metritis. Cows suffering from these disorders were excluded from study. Cows failed to exhibit estrus symptoms by day 45 after calving were submitted to transrectal palpation to

evaluate ovarian state. Ovaries of cows without corpora lutea or luteal cysts were considered as inactive ovaries (true anestrus) whereas ovaries of cows bearing corpora lutea were considered as active ovaries (false anestrus). Cows with active ovaries were isolated and other groups of cows were watched for estrus symptoms until day 65 post calving. Cows not observed in estrus during this period were presented for transrectal palpation and again classified to true and false anestrus according to the status of their ovaries as mentioned before.

Transrectal palpation: Transrectal palpation of ovarian status was carried out by an expert examiner. Corpora lutea were diagnosed according to the size, consistency and their protrusion from the ovarian surface.

Estrus detection: Cows were observed three times daily (morning, afternoon and at 11 p.m.) for at least 30 min each time by well trained farm workers. In this regard, a cow that stood firmly to be mounted by another cow and show a clear, glassy mucus discharge from the vulva was considered as being in estrus. However, estrus was always confirmed by transrectal palpation.

Measurement of ambient temperature: Monthly ambient temperature during the year of study was obtained from National climate center in Baghdad.

Statistical analysis: All statistical manipulations were carried according to the soft ware Sigma sat, Jandel Scientific Software V2.0, 2004 including correlation, regression and Chi square (χ^2).

RESULTS AND DISCUSSION

Overall percentage of cows exhibited estrus symptoms during the months of study year before day 65 post calving was 48.74% (Table 1) with range from 93.31% in the August calving to 28.58% in the November calving (Fig. 1). Meanwhile, the overall percentage of cows failed to exhibit estrus symptoms was 51.27% with range from 71.42% in November to 6.66% in August

Table 1: Total percentage of different parameters of cow's ovarian activity and estrus

Parameters	Total (%)
Cows exhibited estrus	48.73
Anestrus cows	51.27
Cows with delayed estrus till day 45 post calving	49.36
Cows with delayed estrus till day 65 post calving	33.19
Cows with no C.L.s on their ovaries	64.73
Anestrus cows without C.L.s on their ovaries	35.22
Anestrus cows with ovaries bearing C.L.s (un observed estrus)	17.44

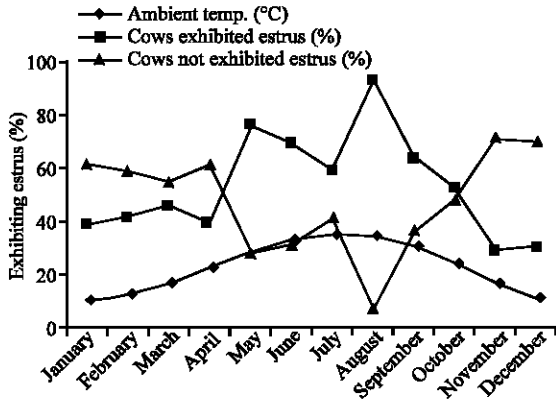


Fig. 1: Influence of ambient temperature on percentage of cows exhibiting estrus till day 45 post calving

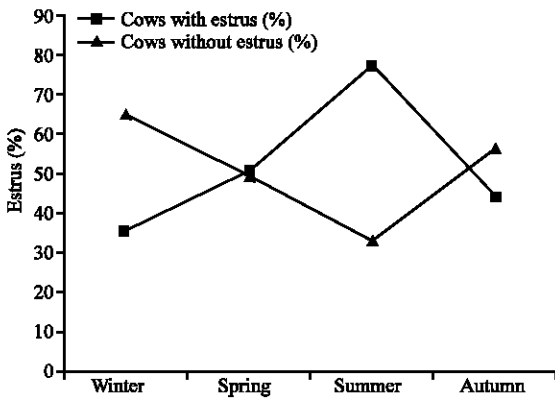


Fig. 2: Influence of calving season on percentage of cows exhibit and not exhibit estrus post calving

(Fig. 1). According to the seasonal classification, high percentage of cows observed in estrus was recorded significantly ($p < 0.01$) during summer 77.23% (Fig. 2) whereas lower percentage was reported during winter 35.33%. At the same time, higher percentage 64.67% of cows not observed in estrus were recorded significantly ($p < 0.01$) in winter and lower percentage 22.77% was recorded in summer (Fig. 2).

The results indicated that the total percentage of cows not observed in estrus till day 45 post calving was 49.36% (Table 1) with range from (72.09-18.18%) in the different months of year (Fig. 3) when the period of estrus signs observation extended to day 65 post calving, the percentage of cows without estrus signs reached 32.9% with range from (0-62.5%) in different months of year (Fig. 3).

The results revealed that the percentage of cows with delay re-establishment of estrus till day 45 post calving were in contravention association with elevation of the ambient temperature, the statistical analysis of the results showed that the regression rate of delayed resumption of

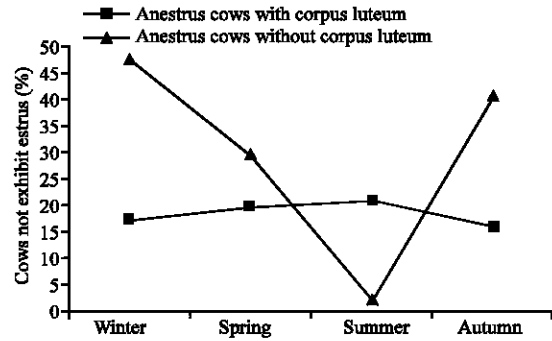


Fig. 3: Influence of season on percentage of cows (not exhibit estrus symptoms) with and without corpus luteum on their ovaries

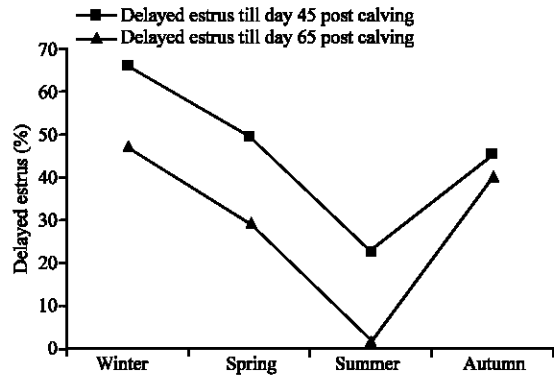


Fig. 4: Influence of season on percentage of delayed estrus till day 45 and 65 post calving

Table 2: Regression and correlation coefficient between the ambient temperature and percentage of cows not observed in estrus till day 45, 65 and silent estrus post calving

Criteria	Regression	Correlation
Cows not observed in estrus till day 45 post calving	-0.019***	-0.88***
Cows not observed in estrus till day 65 post calving	-1.96***	-0.86***
Silent estrus	+0.16	+0.2

*** = $p < 0.0001$

estrus cycles reached (-0.0192) for each rate 1°C rise of ambient temperature ($p < 0.0001$) and high rate of correlation (-0.88) till day 45 post calving. Meanwhile with extending the period of estrus detection till day 65 post calving, the percentage of cows with delayed resumption of estrus activity were lowered with regression coefficient (-1.96) for each rate 1°C ($p < 0.001$) and high correlation coefficient (-0.86) (Table 2). Figure 4 revealed that higher percentage 66.3% of cows with delay in observed estrus activity until day 45 post calving were recorded significantly ($p < 0.01$) in winter and reached 33.7% with extending period of estrus detection till day 65 post calving. Meanwhile, lower percentage 22.77% of cows

with delay estrus activity till 45 days post calving with high significance ($p < 0.01$) recorded in summer and reached 1.98% on day 65 post calving. The results indicated that the total number of cows submitted to clinical examination because of the undetectable estrus symptoms was 241 cows. The clinical examination showed that the total percentage of cows with no corpus luteum palpated on one of their ovaries was 64.73% (Table 1) with range from 87.5% in November to 0% in June and August (Fig. 5). Meanwhile, the overall percentage of cows with palpable corpora lutea detected on their ovaries was 35.27% (Table 1) with range from 20% in December to 100% in June and August (Fig. 6).

According to seasonal classification, the results showed that high percentage 77.22% of cows that calved in summer exhibit estrus symptoms ($p < 0.01$) before day 65 post calving whereas low percentage 35.32% of cows calved in winter were observed in estrus (Fig. 2). According to the results of clinical examination on 241 cows failed to exhibit estrus till day 65 post calving a total percentage of 33.19% were their ovaries without corpora lutea with range from 47.28% in winter to 1.89% in summer.

Meanwhile total percentages 17.82% were their ovaries bearing corpora lutea (non significant) (Table 1) with range from 19.71% in spring to 15.78% in autumn (Fig. 3). The dairy herd in which the current study had been carried out is a year round calving herd. In this regard, it is less urgency in such herd to conceive, compared with cows in a seasonal calving system, there is still a cost benefit to obtain from reducing the interval to conception (Esselmont *et al.*, 2001). The results of the study showed that 48.73% of cows exhibited oestrous symptoms before day 65 post calving during the year of study with a highest percentage 93.31% recorded by cows calved during August and lowest percentage 28.58% was recorded by cows calved during November. The overall percentage of cows with observed estrus signs recorded in this study was relatively lower than the proportion of British and North American dairy herds with observed estrus prior to day 60 post calving (Lamming and Darwash 1998; Lucy, 2001; Moreira *et al.*, 2001). Meanwhile, it is higher than the percentage of estrus cows recorded by Opsomer *et al.* (2000b) in their study two months before calving. Indeed, this total percentage of cows with observed estrus signs were recorded before submitting the anestrus cows to clinical examination for this reason, this percentage would be elevated after the percentage of cows with corpora lutea added. Meanwhile, variation in the percentage of cows with observed estrus during different months of the year could be reflected the variation in level of nutrition and management factors. At same time, in this study overall percentage of anestrus

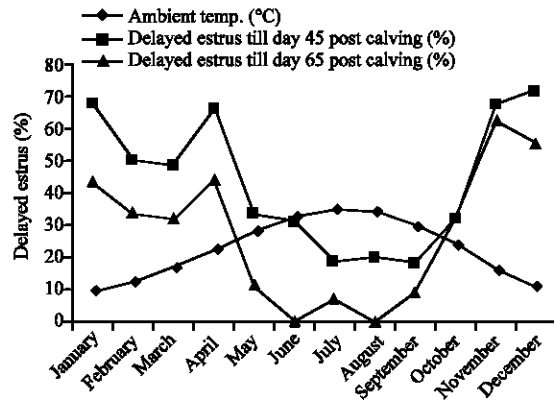


Fig. 5: Influence of ambient temperature on percentage of not exhibit estrus symptoms till day 45 and 65 post calving

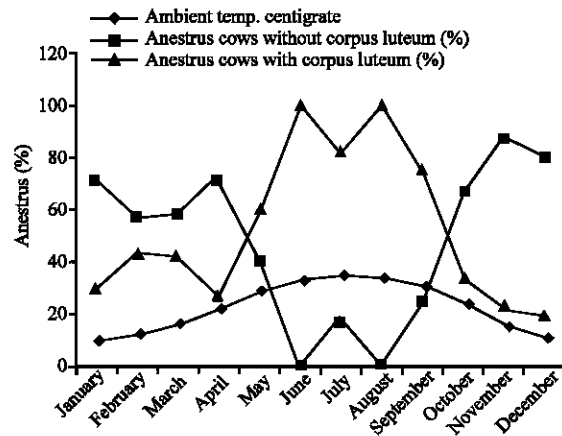


Fig. 6: Influence of ambient temperature on percentage of cows (not exhibit estrus symptoms) with and without corpus luteum on their ovaries

cows approved by clinical examination (day 65 post calving) to has not corpora lutea was 32.19%. This percentage of anestrus cows was within the proportion of North American dairy cows with post calving anestrus 23-38% (Lucy, 2001; Moreira *et al.*, 2001) and higher than the proportion of British dairy cows 11-13% (Royal *et al.*, 2000). Thus, this variation in the proportions gives evidence that the problem of post calving anestrus cows is not limited to climate or geographic location factors only but also recognized in more intensity to management, nutritional and genetic factors.

High correlation coefficient obtained in the present study between rate of ambient temperature and the percentage of cows with post calving anestrus. In this regard, rising 1°C of ambient temperature associated with lowered (1.96) the percentage of anestrus cows during post calving interval. This result is in agreement with several reports indicated that in temperate latitude, the

length in interval between day of calving and first estrus is longer in cold ambient (winter and early spring than autumn calver's) (Bulman and Lamming, 1978; Peters and Riley, 1982; Peters and Ball, 1987).

It is well accepted that increased photoperiod will associate with the rise in ambient temperature (Peters and Ball, 1987). In this regard, changes in daily photoperiod being the cure for onset or termination of ovarian activity (Asdell, 1964). Meanwhile, Peters and Riley (1982) noted a negative correlation between daily photoperiod during late pregnancy and the onset of ovarian cycles post calving explain the current results.

High percentage of anestrus cows 65 day post calving was recorded during November, December and January 62.5, 55.81 and 43.5% subsequently. Whereas, cows calved during the period from May to September recorded low percentage 11.11, 0, 7.4, 0 and 9.09% subsequently of post calving anestrus cows till day 65 after calving. These results corresponding to those obtained by Berka *et al.* (2004). In this regard, two seasonal factors affect the post calving anestrus in cows, the effect of seasonal ration and extreme climate condition. Therefore, these two factors could affect the pre-calving period and influence the ovarian activity of cows after calving.

According to the seasonal classification of calving number and post calving periods, the result indicates that high percentage (77.22%) of cows showed post calving estrus were recorded during summer whereas low percentage 35.32% of cows were recorded in winter. This result can be explained according to nutritional status at and before calving (Peters and Ball, 1987; Rhodes *et al.*, 2003). Pre-calving nutritional status appears to have a greater influence on duration of the post calving anestrus than post calving nutrition (Stagg *et al.*, 1998). Changes in quality and quantity of dietary ration are likely to account for seasonal effect on resumption of ovulatory activity during pre calving period. In Iraq (temperate latitude), there is a well established fact that good quality and quantity of green, grain and dry matters are available during spring and early summer for this reason, cows which expected to calve during summer would provide with high nutritional status during last 2-3 months of gestation.

This explanation is in agreement with the conclusion of McDougall (2001) that the absolute condition at calving is more important than changes post calving on duration of post calving anestrus. The result of clinical examination of anestrus cows showed that 64.73% of the total 241 cows were their ovaries without corpora lutea (anovulatory anestrus) whereas 35.27% of the cows had corpora lutea on their ovaries. The later group of cows was defined as suffering from cessation of observed

estrus symptoms (Opsomer *et al.*, 2000b). Both groups of anestrus cows suffered from prolonged anoestrous during post calving period and result in long days open (Opsomer *et al.*, 2004) and were significantly more at risk of being culled. High percentage of anestrus cows with corpora lutea on their ovaries were recorded during period from June to September 100, 81.82, 100 and 75% subsequently. Although, this high percentage of anestrus cows with corpora lutea may be due to managerial factors (estrus detection failure, housing), this result could focus on the effect of high ambient temperature on this type of anestrus. In this regard, a consequence of increased temperature and humidity result in decreased expression of overt estrus (De Rensis and Scaramuzzi, 2003).

Increase ambient temperature reduced the degree of selected dominant follicle and this can be seen as reduced steroidogenic capacity of its theca and granulosa cells and fall in blood estradiol concentration (Wolfenson *et al.*, 1997). High percentage of anestrus cows without corpora lutea were recorded during winter and autumn 73.11 and 71.87% subsequently. This result =confirmed previous carried out clinical trails in which the Negative Energy Balance (NEB) of the cows were the most important risk factor which lead to delayed cyclicity and anovulation.

In this regard, the degree (Kruip *et al.*, 1998) and the duration (Beam and Bulter, 1997) of the (NEB) have been proven to significantly influence the duration of post calving interval to first ovulation. Moreover, interval to first ovulation after calving has been reported to increase with increasing NEB (Senatore *et al.*, 1996). The shortage in dietary intake of the pre calving and calving period during winter and autumn seasons in current study had an effects on ovarian activity which correlated with changes in circulating Insulin, Insulin like Growth Factor (I, I G F), growth hormone and leptin (in sever NEB). In this regard, dietary induced increases in intra follicular IGF bioavailability, this can increase the sensitivity or response of follicles to FSH and is one mechanism through which nutrition can directly affect follicle recruitment (Armstrong *et al.*, 2003). The dramatic elevation in the percentage 91.3% of anestrus cows with corpora lutea during summer could be due to high intake of Isoflavone during pre calving period and fat mobilization syndrome, beside the limitation of estrus detection during hot ambient in summer (Czyk *et al.*, 2005).

CONCLUSION

It could be concluded that high percentage of imported dairy cows (Holstein-Friesian cross herds) failed to exhibit estrus signs and delayed in resumption of

ovarian activity during post calving interval. Hence, seasonal variations were associated with high percentage of anestrus cows recorded according to such changes during winter and autumn. Whereas, clinical examination (transrectal palpation) was used successfully to differentiate between anestrus cows with inactive ovaries (not bearing corpora lutea) and anestrus cows with active ovaries (bearing corpora lutea) silent and unobserved estrus. There were seasonal variations in the percentage of the previous 2 types of anestrus post calving. However, besides the ambient temperature, photoperiod, ration quality and quantity during calving season however the percentage of anestrus post calving appears to be dependent on previous factors during pre calving season.

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