

Reproductive Performance of Friesian Cows in Saudi Arabia I. Calving Interval, Gestation Length and Days Open

M.S.Salah and H.H.Mogawer

*Department of Animal Production, College of Agriculture,
King Saud University, Riyadh, Saudi Arabia*

Abstract. This study involves analyses of 590 records of Imported and Saudi-born Friesian cows belonging to two farms located at Riyadh region. The overall means for calving interval, gestation length and days open were 414.5 ± 5.8 , 276.4 ± 0.8 and 138.0 ± 5.8 days for imported cows. The corresponding values for local-born cows were 399.8 ± 8.6 , 276.9 ± 1.1 and 122.9 ± 8.5 days. The variations in calving interval primarily were due to those in days open. The effects of farm and season of calving on the later two traits were non-significant. First-parity cows had longer days open and longer calving intervals than older cows. This effect of parity was significant only on imported cows. The relationships between parity with calving interval and days open were negative and significant ($r = -0.16$ and -0.11 , respectively). Cows calving during the summer had shorter gestations than those calving during the winter. This study suggests that good heat detection, proper inseminations and adequate feeding should reduce both calving interval and days open for Friesian cows in Saudi Arabia.

Introduction

Introducing animals to a new environment will change their physiological functions causing changes in their productive and reproductive performance. The larger the difference between the original and the new climate and management, the larger the expected effects [1,2]. It is well known that hot season affects drastically the reproductive performance of dairy cows [3–5]. The cow, rather than the bull, is the main contributor to lower fertility during hot summer season [6].

In Saudi Arabia (semi-arid climate), the importation of high performance dairy cattle have willingly increased throughout the last decade. The average national milk production per cow per year was reported to be 4,800 kg [7] with 15% of the cows reaching a maximum of 7,000 kg. Still, the other productive and reproductive traits of these imported animals, as well as their Saudi-born daughters are not known.

Therefore, this study was conducted to evaluate some reproductive traits of imported Friesian cows raised under the semi-arid climate of Saudi Arabia compared with their local born daughters. The present study includes the calving interval, gestation length and days open as reproductive traits. Also, the study evaluated the effects of farm (herd), season of calving and parity on the above mentioned traits.

Materials and Methods

A total of 590 records of 200 Friesian cows, housed in two farms at Riyadh region of Saudi Arabia, were used in this study. The first farm is the Animal Production Experimental Station which belongs to the College of Agriculture, King Saud University located at the center of Riyadh. The other farm is a commercial private farm located about 70 km south of Riyadh. The foundation heifers were imported pregnant from England to deliver their first offsprings in Saudi Arabia during winter of 1978. In their breeding, the first farm used natural service, while in the second one artificial insemination was used.

Cows were kept in both farms under range conditions with part shade protection against direct solar radiation during summer and rain in winter. Fresh alfalfa was available at morning throughout the year, and hay was provided ad lib.

The cows in each farm were classified into imported and local-born ones. According to the month of calving, the year was divided into two reproductive seasons: winter (Nov.–April, with 17.1°C and 40–50% RH) and summer (May–Oct. with 35°C and RH < 20%). The calving and conception dates were used to calculate the calving interval, gestation length and days open as the dependent variables of this study.

Data were statistically analysed according to the following model:

$$Y_{ijklm} = u + S_i + F_j + C_k + P_l + (SF)_{ij} + (SC)_{ik} + (SP)_{il} + e_{ijklm}$$

where, Y_{ijklm} is the reproductive observation of the dependent variable (calving interval, gestation length or days open) obtained from the m th cow of the i th source and of the j th farm during the k th calving season of the l th parity; u is the overall mean; S_i is the effect of the i th source of the cow (imported, $i = 1$ or local-born, $i = 2$); F_j is the effect of the j th farm ($j = 1$ and 2); C_k is the effect of the k th calving season ($k = 1$ and 2); P_l is the effect of the l th parity ($l = 1, 2, 3$ and more); $(SF)_{ij}$; $(SC)_{ik}$ and $(SP)_{il}$ are the effect of the j th farm, the k th calving season and the l th parity within the i th source of the cow, respectively, and e_{ijklm} is the residual term. All effects in the model were considered fixed except that for the residual term. The data were statistically analyzed by using the Statistical Analysis System (SAS), release 5.16 [8]. The

General Linear Model (GLM), Least Squares Means (LSMEANS) and Correlation (CORR) procedures were used.

Separate analyses were carried out for each year of calving and for the pooled data. Comparisons of the calving years results did not show between-year differences and the model determined from the pooled data is therefore presented.

Results and Discussion

Least squares means and standard errors of calving interval, gestation length and days open for imported and Saudi-born Friesian cows as influenced by farm, calving season and parity are shown in Table 1.

Regardless of all effects, the overall mean of the calving interval was 407.2 ± 4.6 days. This value is higher than that proposed by Vandeplassche [2], who suggested that a calving interval of up to 390 days (i.e. days open 110) to be the most reasonable target. With good heat detection such standard could be reached in dairy cattle under Saudi Arabia conditions. Arther *et al.* [9] working with imported Friesian cows in Saudi Arabia, reported an average calving interval of 381 days. They were able to obtain a much better calving interval (345 days) when the bulls were allowed to run with the cows.

Calving interval obtained for Friesian cows under Saudi Arabia conditions is longer than the optimum calving interval for maximum milk production which is generally considered to be 12 months. It should be mentioned that the optimum interval may not be 12 months under all management and milk production levels. The average calving interval of dairy cattle in United States is approximately 13.5 months [10], about 14 months for Texas dairies [11] and longer than 14 months in some other areas of the world [12,13].

Since the gestation period is utmost fixed variable, the changes in calving intervals are due to changes in days open. The correlation between these two variables was positive ($r = 0.97$) and highly significant ($P < 0.01$), indicating that improving service period by better management and adequate feeding should improve calving interval. The overall gestation mean obtained in the present study was 276 ± 0.6 days (Table 1), which is shorter than that for the same breed under temperate conditions (280 days). This was ascribed to the influence of hot climate [3,5] on hormonal balance [14,15]. This view is supported by our finding that cows calved during hot summer season had significantly shorter gestation than those calved during cool winter season (Table 1).

Table 1. Least squares means and (standard error) for calving interval, gestation length and days open in imported (IM) and local-born (LB) Friesian cows according to farm, calving season and parity.

	Calving interval			Gestation length			Days open		
	IM	LB	Mean	IM	LB	Mean	IM	LB	Mean
Farm:	a	Ab					a	Ab	
1	423.6 (8.8)	384.8 (12.7)	404.2 (7.7)	277.3 (1.2)	278.4 (1.7)	277.8 (1.0)	146.3 (8.7)	106.5 (12.6)	126.4 (7.7)
2	405.4 (7.6)	414.8 (10.1)	410.1 (6.3)	275.6 (1.0)	275.5 (1.3)	275.5 (0.8)	129.8 (7.5)	139.3 (10.0)	134.6 (6.3)
Season:				A		A			
Summer	408.5 (8.7)	407.7 (12.0)	408.1 (7.4)	274.2 (1.2)	275.1 (1.6)	274.7 (1.0)	134.2 (8.6)	132.6 (11.9)	133.4 (7.4)
Winter	a	b		B		B	a	b	
	420.5 (7.7)	391.9 (10.7)	406.2 (6.6)	278.6 (1.0)	278.7 (1.4)	278.7 (0.9)	141.9 (7.6)	113.2 (10.7)	127.5 (6.5)
Parity:	Aa	b	A				Aa	b	A
1	455.7 (10.5)	413.6 (11.0)	434.6 (7.6)	275.9 (1.4)	276.2 (1.4)	276.0 (1.0)	179.8 (10.4)	137.4 (10.9)	158.6 (7.5)
2	B	B	B	B		B	B	B	B
	400.7 (11.4)	410.3 (14.7)	405.5 (9.3)	276.9 (1.5)	279.0 (1.9)	278.0 (1.2)	123.8 (11.3)	131.2 (14.5)	127.5 (9.2)
3	B	B	B	B		B	B	B	B
	391.1 (13.3)	383.8 (17.7)	387.4 (11.1)	277.5 (1.8)	275.8 (2.3)	276.6 (1.5)	113.6 (13.1)	108.1 (17.6)	110.8 (11.0)
>4	B	B	B	B		B	B	B	B
	410.5 (10.6)	391.5 (22.0)	401.0 (12.2)	275.5 (1.4)	276.7 (2.9)	276.1 (1.6)	135.1 (10.5)	114.8 (21.8)	124.9 (12.1)
Overall mean	414.5 (5.8)	399.8 (8.6)	407.2 (9.6)	276.4 (0.8)	276.9 (1.1)	276.7 (0.6)	138.0 (5.8)	122.9 (8.5)	130.5 (4.5)

Same letter or no letter indicates no significant differences. Different letters (small between columns; capital between rows) indicate significant ($P < 0.01$).

Irrespective of all independent effects, days open averaged 130.5 ± 4.5 (Table 1). This period is shorter than that reported by Arora and Sharma [12] for Holstein-Friesian cattle in India and is longer than that reported by Boyd and Munro [16] in Scotland; deKruif [17] in Holand and Arther *et al.* [9] in different herds in Saudi Arabia. These reported differences can be mostly attributed to differences in herd management, particularly in heat detection program. In present study, first heat was detected 58 days postpartum.

Although the imported cows had longer calving interval and days open than the local-born cows (414.5 ± 5.8 and 138.0 ± 5.8 vs. 399.8 ± 8.6 and 122.9 ± 8.5 days, respectively), these differences were statistically insignificant. It should be mentioned that these variations were not due to gestation length since both groups were similar in that respect (Table 1).

Despite that the two farms had used two different service techniques, both had longer calving interval and days open (Table 1). This may be ascribed, partially, to the lack of good skill in heat detection in both farms. Table 1 shows that calving interval and days open were significantly longer for imported than for local-born Friesian cows raised in farm 1 not in farm 2. This within farms difference may be due, in part, to the fact that bulls used in natural mating in farm 1 were brought with the foundation herd when imported and the fertility of these bulls may be temporarily depressed till acclimatization to the new climate was gained. This view is supported by our finding that the values of days open became progressively shorter as parity advanced (Table 1).

Regardless of the source of cows, calving season had negligible influence on mean values of calving interval and days open. Summer pregnancy ended with shorter gestation period, which was only significant in imported cows (Table 1). Imported cows calving during winter season had significantly longer calving interval and more days open than the local-born cows calving during the same season. The heifers of the first group had to deliver their first calves after being introduced to the new environment, during winter season, before becoming fully adapted to the new climate. Therefore, the imported cows had longer calving interval and days open during their first parity compared with local-born cows (Table 1). In another herd located in the eastern region of the Kingdom of Saudi Arabia, Arther *et al.* [9] reported shorter period from calving to conception for cows calved during the hot season of the year compared with those calved during the cooler season. Anand and Balaine [18] and Arora and Sharma [12] in India found no significant effect of season on service period and calving interval of Holstein-Friesian cattle. Some other workers had reported significant effect of calving season on service period [19,20]. Stott and Williams [21] reported that low rate of fertilization and a high rate of embryonic mortality were the major factors causing low seasonal breeding efficiency. Many lactating cows had signs of estrus in fall months after being bred in summer. An absence of thorough estrus detection in some herds prior to the scheduled time for first service is the major cause of increased days open.

Mean calving interval elapsed between first and second calving was 434.6 ± 7.6 days which was significantly longer than those for subsequent intervals. On the other

hand, the imported heifers had markedly longer first calving interval compared with the local-born ones. Furthermore, differences in calving interval between parities shown in Table 1 were more obvious in the imported cows.

Careful examination of the data (Table 1) indicates the positive associations of the calving interval with the days open ($r = 0.97$) and both negatively correlated with parity ($r = 0.16$ and -0.11 , respectively) for imported and local-born cows. Arther *et al.* [9] reported the same trend with shorter periods. Vandeplassche [2] stated that the post-partum anestrus period is markedly longer after first calving than after later calvings, probably due, in part, to diversion of dietary intake for maternal growth. The introduction of the animals to a new environment shortly before their first calving may be another reason. This indicates that the imported animals are somewhat more affected and less adapted to the new climate and management compared with their Saudi-born daughters.

References

- [1] Yeates, N.T.M., Edey, T.N. and Hill, M.K. *Climate and Reproduction*. Animal Sci, Oxford: Pergamon Press, 1975.
- [2] Vandeplassche, M. "Reproductive Efficiency in Cattle". *Anim. Prod. and health paper 25*, Rome: F.A.O., 1982.
- [3] Kelly, J.W. and Hurst, V. "The Effect of Season on Fertility of the Dairy Bull and the Dairy Cow". *J.A.V.M.A.* **143** (1963), 40-43.
- [4] Alexander, G. and Williams, D. "Heat Stress and the Development of the Conceptus in the Foetal Sheep". *J. Agric. Sci.*, **76** (1971), 53-72.
- [5] Webster, A.J.F. *The Influence of The Climatic Environment on Metabolism of Cattle. Principles of Cattle Production*, Eds. Swan and Broster, London: Butter Worth, 1976.
- [6] Stott, G.H. "Female and Breed Associated with Seasonal Fertility Variation in Dairy Cattle". *J. Dairy Sci.* **44** (1961), 1698-1704.
- [7] Al-Khamees, M.H. and Al-Mokhadub, M.S. "Development of Animal and Poultry Production and Related Agriculture Policies in the Kingdom of Saudi Arabia". *1st Confer. Anim. Poultry Prod., Rabat, Morocco*, 1986.
- [8] SAS User's Guide *Statistical Analysis System*. SAS inst. Inc., SAS Circle, P.O.Box 8000, Cary, N.C. 27511-8000, 1986.
- [9] Arther, G.H., Abdul Rahim, A.T. and Ismaiel, A.I. "The Maintenance of Fertility of Cattle Imported into Saudi Arabia" (*Final report*) *SANCSST Project AR:3-0-81* 1983.
- [10] Britt, J.H., ed. *Dairy Cattle: Fertility and Sterility* Ft. Atkinson, WI: W.D.Hoard & Sons Co., 1981.
- [11] Tomaszewski, M.A., Blake, R.W., Baron, R.A. and White, T.H. "Semen Investments by Texas Dairymen Enrolled in the Dairy Herd Improvement Program". *Mimeo, 77th Annu. Mtg. Dairy Sci. Assoc.*, (1981).
- [12] Arora, D.N. and Sharma, J.S "Factors Affecting Some of the Economic Traits in Holstein-Freisian Cattle". *Indian Vet. J.*, **60** (1983), 820-823.
- [13] Gunnar, W.E. "Investigations into The Causes of Infertility in Dairy Cattle in Kuwait and Recommendations for Their Control". *F.A.O.Report Beirut*, (1973).
- [14] Mills, A.C., Thatcher, W.W., Dunlap, S.E. and Vincent, C.K. "Influence of Postbreeding Thermal Stress on Peripheral Plasma Progesterone Concentrations in Heifers". (Abstr.) *J. Dairy Sci.*, **55** (1972), 400.

- [15] Thatcher, W.W. "Effects of Season, Climate and Temperature on Reproduction and Lactation". *J. Dairy Sci.*, **57** (1974), 360–368.
- [16] Boyd, H. and Munro, C.D. "Experiences and Results of a Herd-Health Program". *9th Int. Congr. Anim. Reprod.* A.I. Madrid (1980).
- [17] DeKruif, A. "Efficiency of Fertility Control Program in Dairy Herd". *9th Int. Congr. Anim. Reprod.* A.I. Madrid, (1980).
- [18] Anand, G.R. and Balaine, D.S. "Performance Levels and Inter-Relationships Among Various Reproductive Traits in Holstein Friesian, Jersey and Haryana Purebred and some Crossbred Groups of Dairy Cattle". *Haryana Agric. Univ., J. Res.* **11** (1981), 279–286.
- [19] Dhillon, J.S., Acharya, R.M., Tiwana, M.S. and Aggarwal, S.C. "Factors Affecting the Interval between Calving and Conception in Haryana Cattle". *Anim. Prod.*, **12** (1970), 81–87.
- [20] Mishra, R.R., Chauhan, R.S. and Bhat Nayar, D.S. "A Note on the Effect of Season on Age at First Calving among Brown Swiss X Sahiwal (Red Sindhi)". *Indian J. Anim. Sci.*, **47** (1977), 418–419.
- [21] Stott, G.H. and Williams, R.J. "Causes of Low Breeding Efficiency in Dairy Cattle Associated with Seasonal High Temperatures". *J. Dairy Sci.*, **45** (1962), 1369–1375.

الأداء التناسلي لأبقار الفريزيان في المملكة العربية السعودية ١ - الفترة بين ولادتين، طول فترة الحمل وطول الفترة من الولادة حتى التلقيح المخصب

محمود سيد أحمد صلاح وحسن حسني مجاور

قسم الإنتاج الحيواني، كلية الزراعة، جامعة الملك سعود، الرياض،
المملكة العربية السعودية

ملخص البحث. تضمنت هذه الدراسة تحليل ٥٩٠ سجلاً لأبقار الفريزيان المستوردة والمولودة في المملكة العربية السعودية والتابعة لمزرعتين في منطقة الرياض. كانت المتوسطات العامة للفترة بين ولادتين، وفترة الحمل والفترة من الولادة وحتى التلقيح المخصب هي على التوالي ٥١٤٥ ± ٥٨ ، ٢٧٦٤ ± ٠٨ ، ١٣٨٠ ± ٥٨ يوم للأبقار المستوردة. وكانت لقيم المناظرة للأبقار المولودة محلياً هي ٣٩٩٨ ± ٨٦ ، ٢٧٦٩ ± ٨٥ يوم. وكان مرجع الاختلافات في الفترة بين ولادتين إلى تلك في الفترة من بعد الولادة وحتى التلقيح المخصب. كانت تأثيرات المزرعة وموسم الولادة غير معنوية بالنسبة للفترة بين ولادتين والفترة من الولادة وحتى التلقيح المخصب. أخصبت العجلات بعد الولادة متأخرة عن الأبقار وبالتالي كانت لها فترة بين ولادتين أطول. هذا التأثير لترتيب الولادة كان معنوياً فقط في الأبقار المستوردة. العلاقة بين ترتيب الولادة وبين كل من الفترة بين ولادتين والفترة من الولادة حتى التلقيح المخصب كانت سالبة ومعنوية (معامل الارتباط -٠,١٦، -٠,١١ على التوالي). الأبقار التي ولدت خلال موسم الصيف كانت فترة حملها التالية قصيرة عن تلك التي ولدت في موسم الشتاء.

تقترح هذه الدراسة بأن المراقبة الجيدة لاكتشاف الشيع، والتلقيحات المناسبة والتغذية الكافية لا بد وأن تحفض من طول كل من الفترة بين ولادتين والفترة من الولادة وحتى التلقيح المخصب لأبقار الفريزيان في المملكة العربية السعودية.