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Evaluation of the reproductive performance of Holstein Friesian dairy cows in Alage ATVET college, Ethiopia

Destaw Worku Mengistu* and Kefyalew Alemayehu Wondimagegn

[1]Department of Animal Science, College of Agriculture, Salale University, Salale, Ethiopia.
[2]Department of Animal Production and Technology, College of Agriculture and Environmental Science, Bahirdar University, Bahirdar, Ethiopia.

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The objective of this study was to evaluate the reproductive performance of pure Holstein Friesian dairy cows exploring 28 years records (1987 to 2015) in Alage Agricultural Technical and Vocational Education Training (ATVET) College dairy farm. General linear model procedures of SAS version 9.2 was employed to determine the effects of period of birth, season of birth, period of calving, season of calving and parity on reproductive traits. The overall mean of age at first service (AFS), age at first calving (AFC), calving interval (CI), days open (DO) and number of services per conception (NSC) were 31.8±0.44 months, 42.5±0.46 months, 470.3±9.8 days, 228.2±10.2 days and 1.32±0.03, respectively. Period of birth (P<0.001) and season of birth (P<0.05) exerted significant effect on AFS, while AFC was not significantly influenced by season of birth. Days open and calving interval of Holstein Friesian (HF) cows affected by all fixed factors. Except period of calving (P<0.05), none of the factors influenced NSC. Except NSC, the results obtained for AFS, AFC, CI and DO were disappointing. The most probable factors accounted for the poor reproductive performances (AFS, AFC, CI and DO) in the study area were poor efficiency of estrus detection and expression, poor management practice and health problem and genotype × environmental interactions. Therefore, improving the level of management is required for optimal reproduction performance of HF breed in the area.

Key words: Alage, Holstein Friesian, reproductive performance.

INTRODUCTION

Food insecurity is an appearance of famine challenging in many developing countries, in particular to Ethiopia. Ethiopia is known for its huge livestock population and is estimated to have 59.5 million heads of cattle, about 98.59% of the total cattle in the country are local breeds; the remaining are hybrid and exotic breeds with 1.22 and 0.19%, respectively (CSA, 2016).

Livestock sector in Ethiopia is less productive as compared to its potential, contribution to the Ethiopian economy is very limited, production per animal is extremely low (Kumar and Tkui 2014). The milk production and reproductive traits are crucial factors, determinant for the profitability of dairy production (Lobago, 2007).

*Corresponding author. E-mail: destawworku@gmail.com.

There are common measures of reproductive performance such as age at first service, age at first calving, days open, calving interval, number of services per conception and breeding efficiency (Alemayehu and Moges, 2014). The relative reproductive performance of dairy breeds in Ethiopia has shown to be very poor. Poor genetic performance, poor level of management, poor breeding practice and environmental factors accounted for the poor reproductive performance of dairy cows in Ethiopia. In order to improve the low productivity of the existing breed, selection of the most promising breeds and crossbreeding of these indigenous breed with high producing exotic cattle has been considered as a practical solution (Bekele, 2002).

In Ethiopia, the genetic improvement of dairy cattle is mainly based on cross breeding and adoption of improved exotic breeds. Even though there is a concern about adaptation of pure exotic dairy cattle to tropical environment (climate, feed and disease challenge), pure Friesian and Jersey dairy breeds have been raised by large-scale private and state dairy farms in Ethiopia. But, the productivity of these animals has not been systematically studied and documented. Information on reproductive performance and the factors affecting exotic breeds of Alage ATVET College in particular and that of Ethiopia in general is periodically needed for the planning and management for maximum herd production and high fertility.

Therefore, the aim of the present study was to determine the reproductive performances and document the effects of period of calving/birth, season and parity on age at first service, age at first calving, days open, calving interval and number of services per conception of a herd of Holstein Friesian cows under Alage ATVET College dairy farm, Ethiopia.

MATERIALS AND METHODS

Description of the study area

The current study was carried out at Alage Agricultural Technical Vocational Educational Training (ATVET) College, which is positioned at 217 km southwest of Addis Ababa, near the Abijata and Shala lakes of the Ethiopian Rift Valley. The farm is geographically located at a longitude of 38°30´ east and latitude of 7°30′north, with an altitude of 1600 m.a.s.l. The mean annual minimum and maximum temperature range from 11 to 32°C, respectively. The area has the mean annual rain fall of 800 mm. The rainfall pattern in Alage ATVET College has three distinct seasons; a short rainy season (March to May), a long rainy season (June to September) and a dry season (October to February) (NMSA 2015).

Farm establishment and herd management

Alage dairy farm started in 1980 with a foundation stock of Holstein Friesian origin brought from the Stella dairy farm, Holetta and individual farms around Addis Ababa. Animals were kept under an intensive feeding and production systems, and herds were managed separately based on sex, age, pregnancy, time of calving and lactation.

Animals were stall fed individually with green fodders and roughages, concentrates were supplemented to the animals based on production level and physiological status of animals. Heifers and dry cows were mainly fed on green fodder and other roughages throughout the year. During the day of the rainy season, cows were grazed on native pastures from 1:00 to 3:00 am local time. Later on the day, animals were tied and fed with dry and green fodder, homemade concentrates and mineral licks under the shade.

Animals were fed according to calculated requirements with concentrate feeds and mineral licks during late pregnancy and lactation. Lactating cows were fed 1 kg concentrates per 2.5 kg of milk produced before each milking. Concentrates were prepared by mixing maize with wheat bran, noug cake (*Guizotia abyssinica*), salt and limestone. Hay produced from various types of annual and perennial plants of *graminaceous* and *leguminous* species were used for feeding animals.

Artificial insemination (AI) with semen of purebred HF produced from locally recruited bulls from Ethiopian National Artificial Insemination Centre (NAIC) was used for insemination. Artificial Insemination was done by AI technicians. Detection of estrus was carried out early in the morning and late in the afternoon. Pregnant cows were managed separately during the last trimester and calving was in well-constructed calving pens. Lactating cows were hand-milked early in the morning (8:00 to 9:00 A.M) and late in the afternoon (3:00 to 4:00 P.M). Daily milk yield from individual animals were weighed and recorded. Newborn calves were taken away from their dams shortly after birth and were given colostrums for the first five days of age. Fresh milk was offered twice a day in a bucket until the age of 6 months. They were kept in individual pens. Animals were regularly vaccinated against anthrax, pasteurellosis, blackleg, foot and mouth disease, lumpy skin disease, and contagious bovine pleura pneumonia. Internal and external parasitic infestation were dewormed and sprayed regularly.

Data collection

Data of all cows documented in the history sheet kept on each individual animal record book maintained at Alage dairy farm for 28 years period (1987 to 2015) were used for the study. Data on Dam and Sire ID number, dates of birth, sex of animal, service date and calving dates, calf ID, parity number, drying dates, date and reason of exit were collected from the history sheet. The variables considered as the measure of reproductive performance were age at first service (AFS), age at first calving (AFC), days open (DO), calving interval (CI) and number of services per conception (NSC). Based on climatic condition and weather of the area, seasons of the year were divided into three seasons that is, a short rainy season (March to May), a long rainy season (June to September) and a dry season (December to February). Further, periods of birth were divided into 8 groups; Period 1 (1987 to 1989), Period 2 (1990 to 1992), Period 3 (1993 to 1995), Period 4 (1996 to 1998), Period 5 (1999 to 2001), Period 6 (2002 to 2004), Period 7 (2005 to 2007) and Period 8 (2008 to 2010). For AFS and AFC, cows that were born between 1987 and 1990 were included. Similarly, period of calving was classified into 6 periods; period 1 (1990 to 1993), period 2 (1994 to 1997), period 3 (1998 to 2001), period 4 (2002 to 2005), period 5 (2006 to 2009) and period 6 (2010 to 2015). Unclear and incomplete data were cleaned out. Cases like aborted or had stillbirth were removed from the databases.

Statistical analysis

The data on reproductive traits (AFS, AFC, CI, DO and NSC) of Holstein Friesian dairy cows were entered into Microsoft excel spreadsheet and analyzed by using general linear model (GLM)

Table 1. Least square means ± standard error of age at first service and age at first calving for the fixed effects of period of birth and season of birth.

Source	N	AFS (months)	AFC (months)
		LSM±SE	LSM±SE
Overall CV	244	31.8±0.44 20.52% ***	42.5±0.46 15.67% ***
Period of birth			
P1 (1987-1989)	48	26.63±0.9[ed]	37.5±0.9[ed]
P2 (1990-1992)	13	40.±1.73[ab]	51.9±1.7[ab]
P3 (1993-1995)	37	43±1.02[a]	52.08±1.04[a]
P4 (1996-1998)	24	33.8±1.2[cb]	45.5±1.3[cb]
P5 (1999-2001)	44	23.5±0.9[e]	34.5±0.9[e]
P6 (2002-2004)	23	30.7±1.3[cd]	42.9±1.3[c]
P7 (2005-2007)	18	32.4±1.4[c]	41.7±1.5[cd]
P8 (2008-2010)	37	24.3±1.02[e]	33.6±1.1[e]
Season of birth			
Short rainy	62	33.45±0.8[a]*	43.9±0.8[NS]
Long rainy	85	31.29±0.6[ab]*	41.9±0.7[NS]
Dry season	97	30.68±0.7[b]*	41.6±0.6[NS]

Means separated by different superscript letters under the same variable in one column are significantly different. *** = significant (p<0.001), * = (p<0.05), NS=Not significant, N = number of records, CV= Coefficient of variation, P= Period.

procedures of SAS version 9.2 (SAS, 2008). The study model includes fixed effects of period of calving, period of birth, season of calving, season of birth and parity. Only a few number of animals completed more than 7 lactations and the estimated least square means for parity numbers 7 and greater than 7 were almost similar. Therefore, all parities above 7 were pooled together in parity 7^+. Preliminary analysis showed that interaction effects of the fixed factors were not significant and thus not included in the model. The following statistical models were used to analyze reproductive traits in the farm. The model equations used were:

Model 1: For age at first service (AFS) and age at first calving (AFC)

$Yij = \mu + Bi + Sj + eij$

Where, Yij = Observation on AFS and AFC,

μ = Overall mean,

Bi = Fixed effect of i^{th} season of birth (long rainy, short rainy and dry season),

Sj = Fixed effect of j^{th} period of birth, where P1 (1987-89), P2 (1990-92)…P8 (2008-2010),

eij = Residual random error.

Model 2: For calving interval (CI), days open (DO) and number of service per conception (NSC)

$Yijk = \mu + Bi + Sj + Yk + eijk$

Where, Yijk = Observation on CI, DO and NSC,

μ = Overall mean,

Bi = Fixed effect of i^{th} season of birth (long rainy, short rainy and dry season),

Sj = Fixed effect of j^{th} period of calving P1 (1990-93)…P6 (2011-2015),

Yk = Fixed effect of k^{th} parity (1, 2…7),

eijk = Residual random error.

RESULTS AND DISCUSSION

Age at first service (AFS)

In this study, the overall least square mean of age at first service of Holstein Friesian dairy cows were 31.8±0.44 months which is longer than the age at first service of 733±16 days for Holstein Friesian cows in Ethiopia (Heyredin, 2014), 29.76±0.40 months for Holstein Friesian cows under Sudan tropical conditions (Peters et al., 2007), 24.30±8.01 months for Zebu × Holstein-Friesian dairy cows in Jimma town, Ethiopia (Belay et al., 2012). Reduced growth rate and delayed puberty as a result of poor feeding of calves and low level of nutrient intake by heifers in the farm of Alage ATVET college could have influenced the prolonged AFS obtained.

As presented in Table 1, period of birth (P<0.001) and season of birth (P<0.05) significantly affected AFS. Similarly significant effect of period of birth was reported on AFS of Holstein Friesian cows by Heyredin (2014). Significant effects of period of birth on age at first service in other breeds were also reported by Effa et al. (2011), Tadesse et al. (2010) and Menale et al. (2011). On the other hand, Tadesse et al. (2006) reported non-significant effect of period of birth on AFS on HF dairy cows in Ethiopia. The estimated mean of AFS of Holstein Friesian cows was longest for the cows that were born during P3 (1993 to 1995), while shortest at p5 (1999 to 2001) and p8 (2008 to 2010), respectively. This study indicated that an increasing trend of AFS observed from the heifers that were born in between 1987 and 1995, while decreased from 1996 to 2010 (Figure 1).

Fekadu et al*.* (2010) reported similar findings regarding the effect of season of birth on age at first service. Nevertheless, on purebred Holstein Friesian cows this was less clear (Lemma et al., 2010; Tadesse et al. 2010) under Ethiopian conditions. This study demonstrated that calves born in the dry season tended to be younger at first service than those born in short and long rainy season of Holstein Friesian cows, respectively. This further supports the idea that after the rainy season, grass on natural pastures develops rapidly and lasts through dry season; therefore, AFS is affected by the chances for young cattle to benefit from the wealth of grass. In order to do these calves must be able to digest fiber.

Age at first calving (AFC)

The overall mean of age at first calving for Holstein Friesian heifers was 42.5±0.46 months with coefficient of variation 15.67% (Table 1). This is in close agreement with 42.5±0.7 months for crossbred dairy cows under central highlands of Ethiopia (Effa et al., 2011),

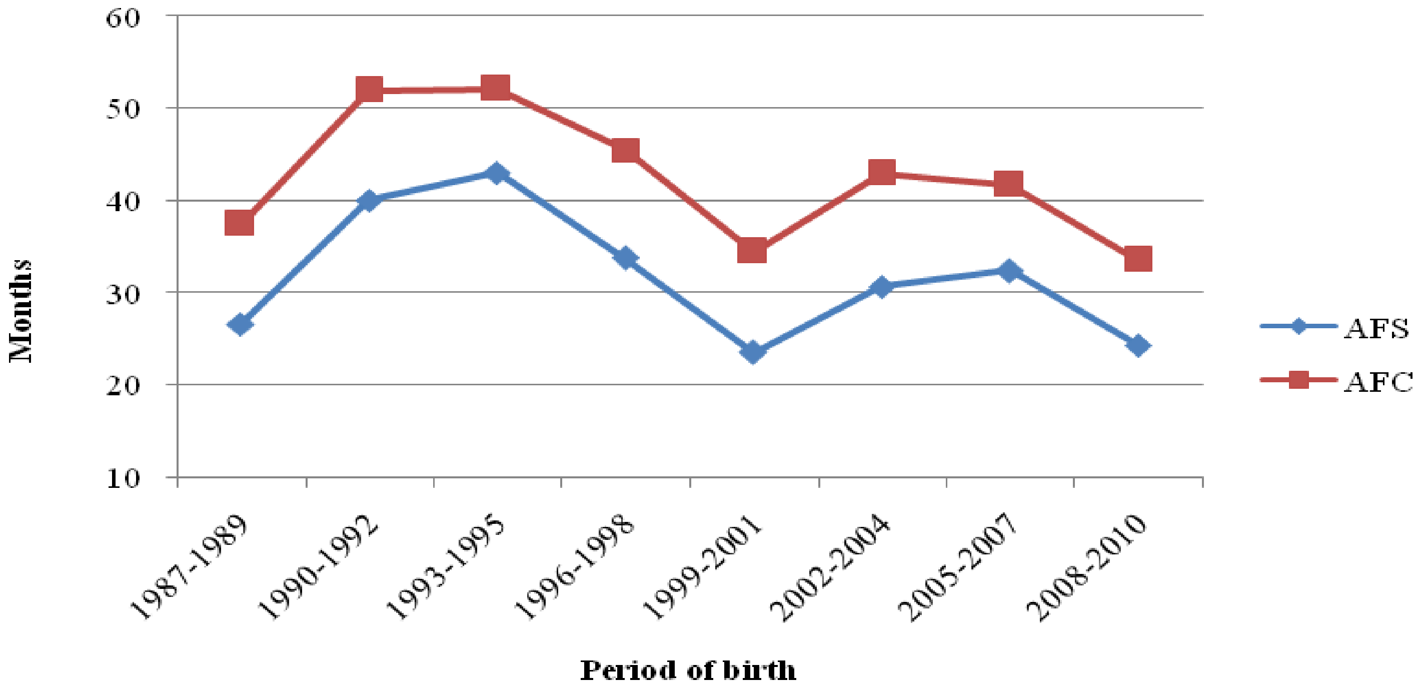

Figure 1. The trend of age at first service and age at first calving of Holstein Friesian heifers over a 23 year period in Alage ATVET College dairy farm.

respectively.

Whereas, estimates in this study for AFC found was higher than previous studies for HF cows that is; 41±6 months in Sri Lanka (Krishantan and Sinniah 2014), 39.2±7.5 months in Ethiopia (Tadesse et al., 2010), 36.48±0.55 months in Ethiopia (Kebede, 2015), 33.27 months in Sri Lanka (Kollalpitiya et al., 2012), 988±9.81 days (Sattar et al., 2005), 894 days for HF in Pakistan (Sandhu et al., 2011) and 912±13.11 days for Holstein-Friesian heifers (Irshad et al., 2011), respectively.

Therefore, the results of the present study obtained significantly differ from previous results reported in the tropics. We found longer values for AFC of Holstein Friesian heifers which deviates from the standards set for commercial dairy farms. This probably accounted for the prevailing climatic conditions and poor management including poor heat detection on heifers.

As indicated in Table 1, period of birth (P<0.001) significantly influenced AFC, while no significance difference was observed between season of birth. This finding was supported by previous findings in the study of Ansari-Lari et al. (2010), Hammoud et al. (2010), Suhail et al. (2010) and Heyredin (2014).

Furthermore, the study findings appear to be well substantiated by the report of Tadesse et al. (2010). In contrast to this study, Tadesse et al. (2006) has reported non-significant effect of period of birth on AFC of HF dairy cows in Ethiopia. Season of birth in this study showed non-significant effect on AFC. However, Peters (2007) reported significant effect of season of birth on AFC for HF cows under sub tropical conditions of Sudan. Analysis of data showed that the shortest value of AFC was observed during P5 (1999 to 2001) and P8 (2008 to 2010), whereas the longest value of AFC was recorded during P3 (1993 to 1995), respectively (Table 1). It is fundamental to note that, the trend of AFC over period of birth was inconsistent (Figure 1). An increasing trend of AFC observed in heifers that were born in between P1 and P3 (1987 to 1995), while decreasing trend was observed from P4- to P8 (1996 to 2010) (Figure 1).

Generally speaking, age at first calving of Holstein Friesian cows found in the present study showed a declining trend from period to period (Figure 1). This could be attributed to management fluctuation among years and the recommended amounts of energy were not fed for calves.

Calving interval (CI)

The overall least square mean of CI of 470.3±9.8 months found in this study differ from CI of 15 months (457.5±152.5 days) reported for Holstein Friesian cattle in the Hill country of Sri Lanka (Krishantan and Sinniah, 2014).

Despite this, the mean CI obtained in this study was higher than the least squares means of CI of 403.1 days (Hammoud et al., 2010), 408.09 days for HF in Pakistan (Sandhu et al., 2011), 433.12±6.70 days (Peters, 2007)

Table 2. Least square means ± standard errors of days open, calving interval and number of service per conception for the fixed effects of period of calving, season of calving and parity.

Source	N	DO (days)	N	CI (days)	N	NSC
		LSM±SE		LSM±SE		LSM±SE
Overall	56	228.2±10.2	55	470.3±9.8	98	1.32±0.03
CV (%)		60.22		23.12		42
		***		***		
P/calving						
P1 (1990-93)	74	272.6±19.9^{a}	35	467.58±20.3^{ab}	78	1.32±0.07^{ab}
P2 (1994-97)	70	245.2±19.3^{b}	72	496.9±16.2^{ab}	83	1.34±0.06^{ab}
P3 (1998-01)	163	225.4±14.2^{b}	103	436.1±14.5^{cb}	160	1.24±0.05^{b}
P4 (2002-05)	150	263.7±14.1^{ab}	153	488.8±12.7^{ab}	207	1.24±0.04^{b}
P5 (2005-09	72	214.9±18.7^{acb}	70	514.6±15.6^{a}	103	1.45±0.05^{a}
P6 (2010-15)	127	147.4±14.5^{c}	132	417.5±12.9^{c}	167	1.29±0.04^{ab}
		***		***		
S/calving						
Short rainy	148	250.7±14.5^{a}	131	476.1±12.7^{ab}	197	1.30±0.04
Long rainy	323	218.7±13.5^{b}	160	481±12.6^{a}	218	1.33±0.04
Dry	185	215.2±11.4^{b}	274	453.7±10.8^{b}	383	1.30±0.03
		***		***		
Parity						
1	208	294.7±10.5^{a}	4	433.3±57^{c}	229	1.38±0.03^{NS}
2	183	231.6±11.1^{ab}	185	538.7±8.5^{a}	204	1.29±0.04^{NS}
3	128	231.3±13.1^{ab}	149	474.9±9.5^{b}	152	1.33±0.04^{NS}
4	76	197,1±17.1^{bc}	109	466±11^{bc}	105	1.37±0.05^{NS}
5	35	196.2±24.7^{bc}	65	447±14.6^{bc}	61	1.28±0.07^{NS}
6	11	252.5±43.6^{ab}	30	452.5±20.8^{bc}	27	1.23±0.1^{NS}
7	15	194.5±37.7^{c}	23	478.7±23.7^{b}	20	1.30±0.12^{NS}

Means separated by different superscript letters under the same variable in one column are significantly different. *** = Significant (p<0.001), * = (p<0.05), NS=Not significant, N = number of records, CV= Coefficient of variation, P= Period, P/calving= period of calving, S/calving= season of calving.

and 445±90.8 days for Holstein Friesian cows in the three dairy herds; Holetta, Stella and Dinkity dairy farms of Ethiopia (Tadesse et al., 2010).

Therefore, the CI found in the present study is much longer than the value we expected from the calving interval of HF dairy cows kept under intensive management conditions. This longer calving interval would seem to show poor management of the existing farm including poor breeding management than most reports in the tropics. The LSM±SE of calving interval for the fixed effects of period of calving, season of calving and parity are summarized in Table 2. This finding demonstrated that period of calving (P<0.001), season of calving (P<0.05) and parity (p < 0.001) had source of variation on CI of HF dairy cows.

The study findings are consistent with previous reports in Ethiopia (Tadesse et al., 2010; Million and Tadelle, 2003). A study conducted by Melendez and Pinedo (2007) confirmed the significant effect (P<0.05) of season and year of calving on CI of Holstein Friesian cows in Chile. Furthermore, Peters (2007) and Iffa et al., (2006) supported the idea that parity was a source of variation for CI of Holstein Friesian cows. On the other hand, Mulindwa et al. (2006) in Uganda found that parity did not show significant affect on CI. This finding showed that, the highest calving interval was recorded at the cows that were calved during P5 (2007-10), whereas lowest during P6 (2011-15). Generally speaking, the trend of calving interval over several years was inconsistent (Figure 2).

The significant effect of season of calving is in line with the report of Hammoud et al. (2010) for Holstein Friesian cows under semi-arid conditions in Egypt. This finding noted that cows that were calved during dry season had better CI in contrast to short and long rainy season, respectively (Table 2). This might be due to rainy periods followed by dry periods, proved that cows calved in the dry season could take advantage of improved nutritional conditions during the subsequent rainy season. Cows with first parity recorded lowest CI, while highest at parity 2 (Table 2).

Days open (DO)

Days open is the part of the calving interval, longer days

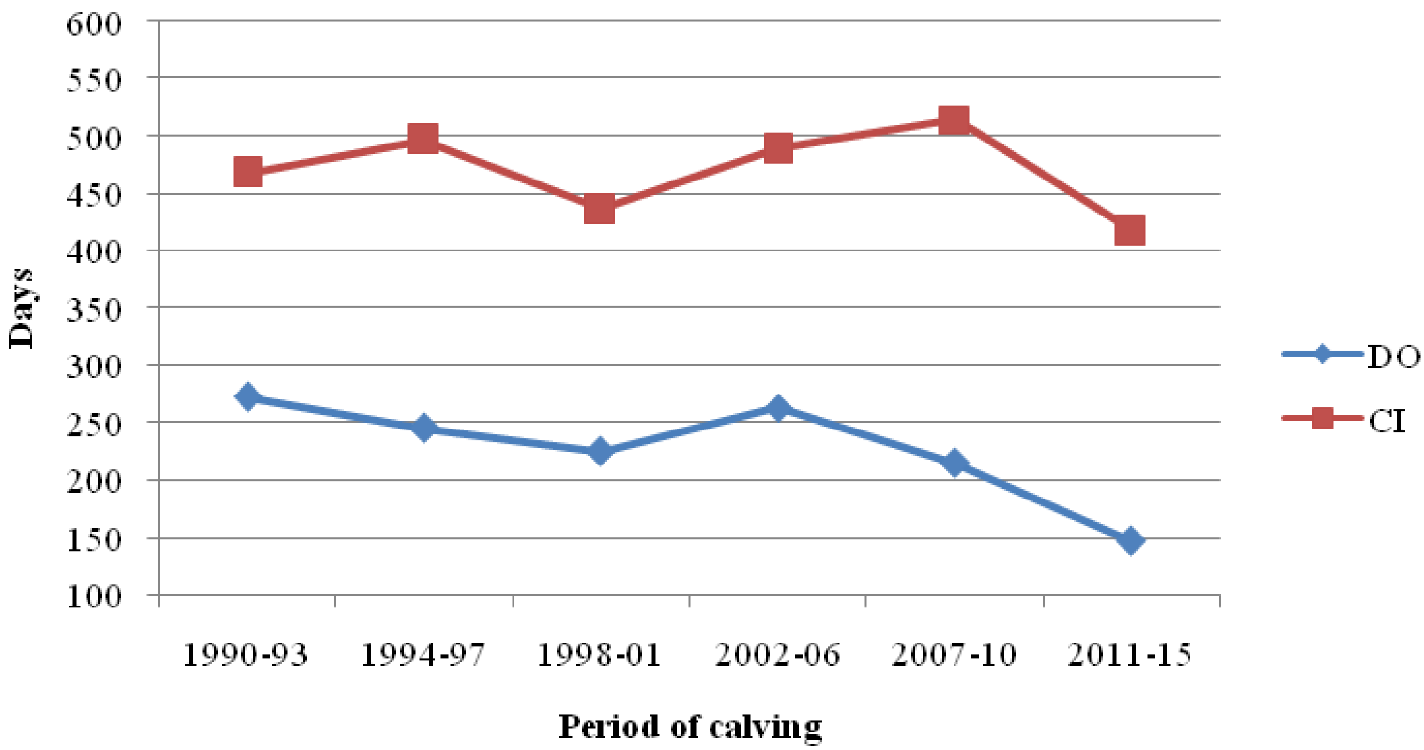

Figure 2. The trend of days open and calving interval of Holstein Friesian cows over a 25 year period in Alage ATVET College dairy farm.

open associated with decreased profitability in the private as well as state farm. The overall least square mean of DO of Holstein Friesian cows was estimated as 228.2±10.2 days (Table 2). This value was much higher than the estimates of 130.7 and 141 days as reported by Hammoud et al. (2010) and Shalaby et al. (2001), 167.79±7.08 days as reported by Peters (2007) and mean DO of 148±1.72 days with a coefficient of variation of 11% for HF cows in Ethiopia as reported by Tadesse et al. (2010). On top of that, DO of 150 and 205±2.6 days was reported for HF dairy cows in Turkey and Tanzania (Cilek, 2009; Asimwe and Kifaro, 2007), respectively.

As indicated in Table 2, period of calving (P< 0.001), season of calving (P<0.05) and parity (p< 0.001) showed source of variation on DO of HF dairy cows. Similar to the current study, significant effects of period of calving (P<0.001) on DO was reported by Asimwe and Kifaro (2007). A study by Melendez and Pinedo (2007) found that season and year of calving had significant effect (P<0.05) on DO. In contrast, Tadesse et al. (2010) reported non-significant effect of season of calving on DO of Holstein Friesian cows.

Mean days open was shortest during latter period (2011 to 2015), while longest during period 1 (1990 to 1993). The progressively decreased trend in days open over the period of calving is an indicative of improved management, adaptation of HF breed to the environment through time or both. Mean days open was highest at short rainy season, while there was no significance difference between long rainy season and dry season.

This study showed that mean days open significantly decreased from 1st to 5th parity, increased at 6th parity, while decreased again after parity seven (Table 2). Cows in the first parity had significantly longest DO, while shortest at 7th parity (Table 2). Despite the fact that, parity also resulted in significant variation for DO of Holstein Friesian cows and was lowest at first parity, while highest at 4th parity (Peters, 2007). The longer DO of cows calved in parity one and decreasing trend of DO with advancement in age in the current study agreed with the findings reported by Asimwe and Kifaro (2007).

Number of service per conception (NSC)

The average number of service per conception of Holstein Friesian cows in the present study was 1.32±0.03. The mean services per conception obtained in this study was lower than that of previous reports of 1.8±0.09 for Holstein Friesian dairy cows in Hossana, Ethiopia (Kebede, 2015), 1.81 for Holstein Friesian cows in central highlands of Ethiopia and Sri Lanka (Tadesse et al., 2010; Krishantan and Sinniah, 2014), 2.0 for Holstein Friesian cattle in Nigeria (Ngodigha et al., 2009)

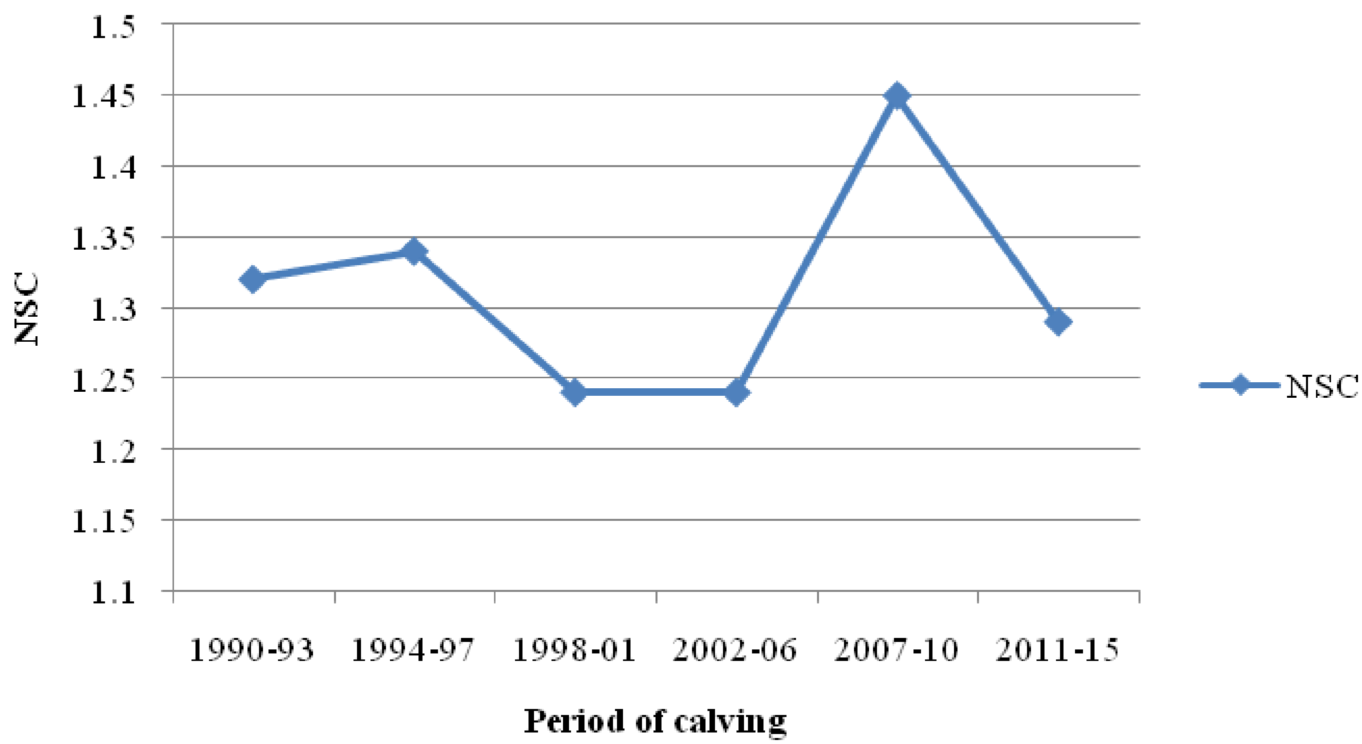

Figure 3. The trend of number of service per conception Holstein Friesian cows over a 25 year period in Alage ATVET College dairy farm

and 2.5 for Holstein Friesian in Iran (Ansari-Lari et al., 2010).

However, Heyredin (2014) reported that the NSC of HF cows was 2±1 in Holstein Friesian dairy cows at Holeta bull dam station and genesis farms, 1.67 as reported from mid Rift valley of Ethiopia (Yifat et al., 2009), 1.52 as reported by Dinka (2012). By far, NSC of 3.30 and 2.80 was reported (Lateef, 2007; Sandhu et al., 2011) for Holstein Friesian dairy cows in Pakistan. Variations in the environment, management, and the skill of AI technicians accounted for the observed differences in NSC. The study results of number of service per conception were good as compared to most reports in the tropics.

As indicated in Table 2, a significant effect of period of calving on number of service per conception (NSC) of Holstein Friesian cows was observed ($P<0.05$), while no significant difference was found on the effect of season of calving and parity to NSC. This study confirmed that, there was no significance difference between parities on NSC of HF dairy cows. Despite this, Heyredin (2014) and Tadesse et al. (2010) noted the significant effect of parity on NSC of HF cows. A study by Melendez and Pinedo (2007) found significant effect ($P<0.05$) of season and year of calving on NSC. Moreover, significant influence of period of calving on NSC ($P<0.05$) was reported by several authors; Besufkad (2008), Ngodigna et al. (2009), Avendaño-Reyes et al. (2010), Hammoud et al. (2010) and Motlagh et al. (2013). In contrary to the aforementioned report, non-significant effect of period of calving and season of calving was reported for NSC of HF cows in Ethiopia (Tadesse et al. 2010). The non-significant effect of season of calving in the present study well agreed to zero grazing practice in the farm, which makes the effects of seasonal variation in forage developments and feed availability minimal (Gebeyehu et al., 2007).

Mean number of service per conception was highest at the cows that were calved during P5 (2007 to 2010), while lowest at P3 and P4 (1998 to 2006), respectively. On the other hand, NSC showed inconsistent trend over period of calving. The inconsistent trend of NSC over period of calving proved negligible climatic condition, poor breeding including lack of skilled inseminator throughout the years.

CONCLUSIONS AND RECOMMENDATION

The average mean value found for NSC was surprisingly good as compared to other studies. Despite this, the values for the traits of age at first service, age at first calving, calving interval and days open were not ideal and below expectations. This poor performance was expected due to the fact that inability of higher graded cows to withstand the prevailing environmental and management condition. So there is room for improvement of these traits as better performances are also reported in the tropics.

Age at first service was significantly influenced by both period of birth and season of birth. Despite this, season of birth did not have significant effect on age at first calving. All fixed factors exerted significant variation on days open and calving interval of Holstein Friesian cows. However, there is a room for the improvement of these environmental factors to maintain the optimum calving interval and days open. This finding confirmed that highest coefficient of variation of DO would seem to suggest that poor record keeping practice and absence of selection in the farm.

The current study was also limited to see other factors like Dam line, Sire line and other dairy character traits. Therefore, further studies, which takes the above factors in to account are therefore required. Since period of calving and period of births had source variation on the reproductive traits, due attention for the inconsistent management practice across the years will help to address better productivity.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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