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Comparative Milk Production Performance Evaluation of Holstein Friesian Cattle Breeds in the Two Different Agro Ecological Systems: The Case in Alage and Ardaita Atvet College Dairy Farm, Oromia Region, Ethiopia

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Abstract: The comparative study was conducted at Alage and Ardaita ATVET College, to evaluate milk production performance of Holstein Friesian dairy cows under two different agro ecological systems. The compiled data collected from 2000-2015 G.C on milk production traits were studied and analyzed. Three months follow-up study was also conducted to obtain morning and evening milk production based on agro ecology, lactation stages, parity class and lactation months. The results of the follow up study showed that the overall least square means and standard errors of morning and evening milk yield were 6.65±0.02 kg and 5.46±0.02 kg, respectively. Whereas, the overall least square means and standard errors of lactation milk yield and lactation length were 3078.51±54.74 kg and 314.11±4.24 days. All non-genetic factors showed source of variation for morning and evening daily milk yield. Season of calving ($p<0.05$), year of calving and parity ($P<0.001$) had significant effect on LMY and LL. Whereas, agro ecology had no significant effect ($P>0.05$). The result obtained for LL in the study area were within the standards set from commercial dairy farms. However, the LMY of Holestien Friesian cows reported in this study was lower than the LMY performance reported in many tropical regions. Therefore, attention should be given for management factors accounted for this low level of LMY.

Key words: Agro-ecology · Holstein Friesian · Milk production · Monitoring study

INTRODUCTION

Livestock production constitutes to be an important sub-sector of the agricultural production in Ethiopia, contributing 45% of the total Agricultural Gross Domestic Product [1]. Livestock sector has a significant contribution to the Ethiopian economy but production per animal is extremely low [2]. The average cow milk production was estimated 1.54 liters /cow per day [3] and the per capita milk consumption was only about 16 kg/year, which is much lower than African and world per capita averages of 27 kg/year and 100 kg/year, respectively [4]. Some improvement also reported in per capita consumption of milk and estimated it at 19.2 kg [5] but still production is lagging far behind the demand. This low per capita milk consumption is mainly emanated from poor genetic potential of local cattle for dairy traits. Besides their genotype, the performance of dairy animals is also affected by many environmental factors. These environmental factors may suppress the animal's true genetic ability and create a bias in the selection of animals [6].

Exotic dairy breeds have been introduced from time to time in Ethiopia, a herd of Holstein Friesian cattle are maintained at Alage and Ardaita ATVET college farm. At present both farms are the major farms consisted mainly of Holstein dairy herds established with the aim to fulfill the ever-increasing demands of milk and milk products to the college and surrounding community. Performance of these animals is affected by many genetic and non-genetic factors. The periodical evaluation of factors affecting productivity of animals is very crucial for future

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planning and management. Furthermore, comprehensive information on production performance of Holstein Friesian dairy cows in Alage and Ardaita ATVET College comprising different agro ecology is limited. Hence, there is a need to periodical evaluation of productive performance of dairy cattle and factors affecting their performance. Therefore, the present study designed to evaluate the comparative milk production performance between two different agro ecology and the factors affecting the productive traits of HF cows reared under intensive dairy production system in Alage and Ardaita ATVET college dairy farm.

MATERIALS AND METHODS

Description of the Study Area: The study was conducted at Alage and Ardaita Agricultural technical vocational education training (ATVET) Colleges, which is the federally administered colleges under the Ministry of Agriculture and Rural Development (MoARD).

Alage College: Is situated at 217 km southwest of Addis Ababa, in the vicinity of the Abijata and Shala lakes of the Ethiopian Rift Valley. The farm rests on 4,200 ha of land, at a longitude of 38° 30 east and a latitude of 7° 30' north, with an altitude of 1,600 m.a.s.l. The area is characterized by mild tropical weather with a minimum and maximum temperature ranging from 11°C to 29°C and experiences a bimodal rainfall distribution with an annual average of 800 mm.

Ardaita College: Is about 305 kilo meter far away to south east of Addis Ababa. The College is located in Gedeb Assasa woreda, West Arsi Zone of Oromia National Regional State, encircled with farmlands at an altitude of 2410-2610 meter above sea level with 37°11'30" east longitude and 4°17'20" north latitude in southeastern Ethiopia of Oromia National Regional State in the high land of Arsi zone. The mean annual rainfall is 1200 mm and maximum and minimum temperature ranges from 20°C and 5°C, respectively. Based on agro climatic condition and

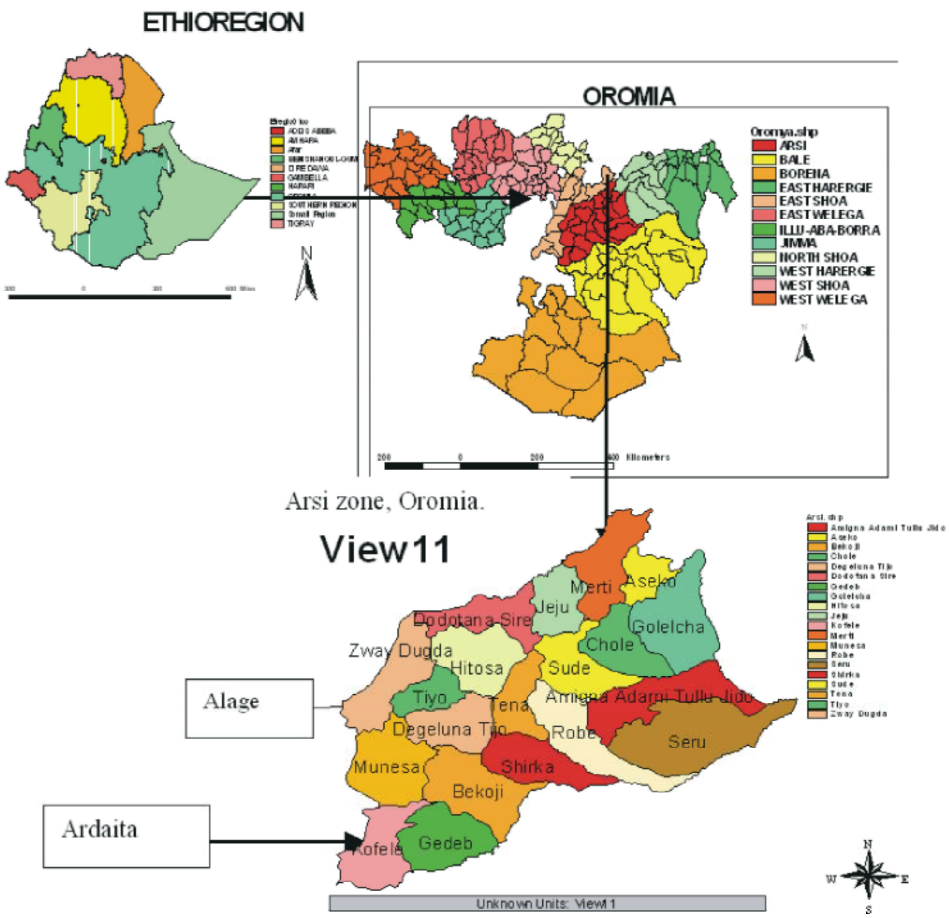

Fig. 1: Map of Ethiopia (top write), part of Oromia (top left) and parts of Arsi zone (bottom) indicating the study site Alage and Ardaita.

rainfall, the area has three distinct seasons. A short rainy season, which extends from March to June, a long rainy season, which extends from July to October and a dry season that extends from November to February [7].

Establishment of the Farm and Breed Groups: Alage dairy farm was started its dairying activity in 1980 with foundation stock of 300 females and four males of Holstein–Friesian origin brought from the Stella private dairy farm, Holetta and individual farms around Addis Ababa. While, Ardaita dairy farm was established in 1984 by purchasing 50 first cross of Friesian X Boran from Gobe agricultural development unit. The Alage dairy farm was consisted mainly of Holstein Friesian cattle population, while Ardaita dairy farm was engaged with Holstein Friesian and its crosses with Boran to produce milk and milk products to fulfill the ever-increasing demand for milk and milk products in the area.

Animal Management and Monitoring: Animals were maintained under intensive systems and Herds are managed separately based on sex, age, pregnancy and lactation. Animals were liberally stall fed with green fodders and roughages, concentrates also fed to the animals according to the need. Heifers and dry cows were mainly fed on green fodder and other roughages throughout the year. At Both farms, artificial insemination was practiced by bringing pure Holstein Friesian semen from National Artificial Insemination Center (NAIC). The insemination practice was carried out by AI technicians. Detection of estrus was carried out twice a day, early in the morning and late in the afternoon.

Cows are grazed on native pastures during the rainy season from 1:00 - 3:00 am local time. After that, the animals are tied and stall-fed with required quantities of dry and green fodder, concentrates and mineral licks under the shade. Animals on both farms were stall-fed and supplemented with concentrate feeds and mineral licks during late pregnancy and lactation. In all herds Lactating cows received concentrates before each milking at the rate of 1 kg of concentrate per 2.5 kg of milk produce. Concentrates are 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 Gramineae species, namely, *Paspalum conjugatum, Digitaria ciliaris, Cyperus asculantus* and *Hyparrhenia* species are used for feeding animals.

Pregnant cows were managed separately during the trimester; they calved in well-constructed calving pens. Newborn calves are taken away from their dams shortly after birth and allowed to receive colostrums for the first five days of their age and bucket-fed until weaning ; they managed in individual pens. Lactating cows are hand-milked twice daily at all farms, early in the morning (3:00 - 4:00 pm) and late in the afternoon (3:00 - 4:00 pm) and daily milk yield from individual animals were weighed and recorded. 96 lactating Holstein Friesian cows in both farms (60 from Alage and 36 from Ardaita) were included in the monitoring study. There was regular vaccination against anthrax, pasteurellosis, blackleg, foot and mouth disease, lumpy skin disease and contagious bovine pleura pneumonia. There was regular dosing and spraying against internal and external parasites.

Data Collection: Data for this study were collected from two dairy herds, Alage and Ardaita Agricultural Technical and Vocational Education Training College dairy farms. Monitoring study concerning morning and evening daily milk production collected for the period from 1- 1-2015 to 5- 30 - 2015 G.C from each individual lactating cow. It was collected based on agro ecology, lactation phase, parity class and lactation month. In monitoring study, the data were collected by assigned individuals. The milk yield of monitored animals was measured using plastic measuring cylinder and registered on the prepared format twice a day, morning and evening, until the end of May to estimate average morning and evening daily milk yield. While, data concerning lactation milk yield and lactation length of Holstein-Friesian calving between 2000 and 2015 G.C were collected from the history sheet kept on each individual animal record book maintained at the farm. Records has identification number, sex of animal, date and reason of exit, dates of birth, dam and sire ID number, calf ID, service date and calving dates, daily milk yield, parity number, season of milking and drying dates. From the collected information the parameters of productive performance, i.e., lactation milk yield (LMY) as the total lactation milk yield and lactation length (LL) obtained by counting the number of days from the date of calving till the cow ceases to produce milk were studied. The compiled record cards were checked for its completeness and unclear and incomplete data were cleaned out.

Data Analysis: Three months follow up data and data of all cows archived over 14 years period on Alage and Ardaita dairy farms were used for the study.The lactation yields that were discarded were those with incomplete data, or because of too short or too long lactation length.The data interred into Microsoft excel spread sheet and analyzed using general linear model (GLM) procedures of SAS version 9.2 [8]. The model used includes fixed effects of Agro ecology, lactation phase, lactation month, season, parity and years. From the model, Ardaita characterized as highland (from 2410-2610

M.A.S.L) and Alage as lowland (1600 M.A.S.L). Lactation phases were classified in to three phases; phase 1 which extends from 0-70 days after calving, phase 2 which extends from 71-145 days after calving and phase 3 which extends from 146-305 days after calving. Lactation months were classified in to 1 (March), 2 (April) and 3 (May). Similarly Months of the year were classified into three seasons based on rain fall distribution; a short rainy season which extends from March to June, a long rainy season, which extends from July to October and a dry season that extends from November to February. The number of observation of animals that calved during 2002 and below were too small there for all animals that calved below 2002 were pooled together in 2002. Likewise, the number of observation of animals that calved during 2014 were too small therefore, all animals that calved at 2014 and above this were pooled together in 2014. Number of observation of animals that had parity 5 and above were too small and the estimated least square means for parity numbers 5 and greater than 5 were almost similar. Therefore, all parities above 5 were pooled together in parity 5. The following models were used to analyze milk production traits in both farms.

Model 1: For Morning (MMY) and Evening (EMY) daily milk yield.

$Y_{ijkl} = \mu + B_i + Sj\ Y_k + M_l + eijkl$

where

Y_{ijkl} = n^{th} record of i^{th} agro ecology, j^{th} parity class, k^{th} phase of lactation and l^{th} lactation months

μ = Overall mean

B_i = Fixed effect of i^{th} agro ecology (highland and lowland)

Sj = Fixed effect of j^{th} parity class (j= 1, 2, 3….5)

Y_k = Fixed effect of k^{th} phase of lactation (1, 2 and 3)

M_l = l^{th} lactation month (March, April and May)

$e_{ijk\,l}$ = Random error associated with each observation

Model 2: For lactation milk yield (LMY) and lactation length (LL)

$Y_i = \mu + B_i + S_j + y_k + P_p + eijkp$

where

Y_{ijkp} = Observation on LMY and LL

μ = Overall mean

B_i = Fixed effect of i^{th} agro ecology (highland=Ardaita, lowland=Alage)

S_j = Fixed effect of j^{th} season of Calving (long rainy, short rainy and dry season)

Y_k = Fixed effect of y^{th} year of calving (2000-2015 G.C)

P_p = Fixed effect of p^{th} parity (1, 2…5)

eijkp = Residual random error

RESULTS AND DISCUSSIONS

Morning and Evening Daily Milk Yield (MMY and EMY): The overall least square means and standard errors of morning and evening milk yield of monitored Holstein Friesian cows were 6.78±0.02 kg and 5.53±0.02 kg with coefficient of variation 29.9 and 31.78%, respectively. The least square means and standard errors of morning and evening milk yield (Table 1) showed that phases of lactation and parity had significant effect (P<0.001). Lactation months was significant (p<0.001) on MMY and EMY of Alage Holstein Friesian cows. Furthermore, lactation months had significant effect on MMY (p<0.001) and EMY (p<0.05) of HF cows at Ardaita ATVET college. Agro ecology had no significant effect on MMY and EMY of HF cows. The influence of climatic conditions on cross of Holstein Friesian dairy cows may be negligible under optimal feeding and management conditions [9].

At both farms, the milk yield was significantly higher in the morning than in the evening for the three phases of lactations. For Alage Holstein Friesian cows, higher value of morning and evening daily milk yield observed in the first phases of lactation than second and third phases of lactation, respectively. Conversely, for Ardaita Holstein Friesian cows, higher values observed in the second phase of lactation than first and third phases of lactation. However, the mean value found in this study were higher than 4.17±1.89 kg, 2.84±1.18 kg and 3.65±1.47 kg and 2.43±1.01 kg, 2.25±0.95 kg and 1.45±0.58 kg for morning and evening milk yield for crossbred dairy cows in Jimma, Ethiopia [10]. Besides, higher milk production in the morning than in the evening and a decreasing trend of morning and evening milk production in the third phases of lactation were observed. This study in close agreement with the milk yield was decreased significantly in the third stage of lactation than that of first and second (P<0.01) [10, 11].

Significantly higher milk production were produced in the morning than in the evening in all parities of monitored Holstein Friesian cows. Similar to the present study crossbred cows produced more milk in the morning than in the evening because the milking time interval was higher than evening [12]. The results of the current study revealed that the highest morning and evening milk yield obtained in parity 3 of monitored Holstein Friesian cows in Alage, while lowest value observed in parity 1 and significantly increased from 2^{nd} parity - 4^{th} parity and then showed a declined trend in parity 5 (Table 1).

Table 1: Least square means and standard errors for morning and evening milk yield on agro ecology, lactation phase, parity and lactation month (monitoring study)

	MMY(kg)				EMY(kg)	
Factors	N		LSM±SE		LSM±SE	
over all	6442		6.78±0.02		5.53±0.02	
CV (%)			29.9		31.78	
A/ecology		NS			NS	
Highland	2380		6.74±0.04		5.50±0.04	
Lowland	4062		6.8±0.03		5.56±0.03	
	MMY			EMY		
	N	Alage	N	Ardaita	Alage	Ardaita
Lac/ phase	***		***	***	***	
Phase 1	854	7.97±0.07^{a}	463	6.38±0.08^{b}	6.54±0.05^{a}	5.08±0.08^{b}
Phase 2	776	7.13±0.07^{b}	539	8.23±0.08^{a}	5.8±0.06^{b}	6.9±0.07^{a}
Phase 3	2432	5.49±0.04^{c}	1378	5.42± 0.05^{c}	4.45±0.03^{c}	4.41±0.04^{c}
Parity		***		***	***	***
1	1228	5.97±0.05^{d}	460	6.93± 0.07^{a}	4.85±0.05^{d}	5.7± 0.07^{a}
2	864	7.10±0.06^{b}	502	6.57±0.08^{b}	5.78± 0.05^{b}	5.37±0.08^{c}
3	517	7.48±0.08^{a}	536	6.14± 0.07^{c}	6.17±0.07^{a}	4.87±0.07^{d}
4	1062	7.23±0.06^{ab}	398	6.57±0.06^{b}	5.89±0.05^{b}	5.35±0.08^{c}
5	391	6.56±0.09^{c}	384	7.2±0.1^{a}	5.30± 0.08^{c}	6.02±0.09^{a}
Lac/ month		***		***	***	*
March	1312	6.31±0.05^{c}	813	6.85±0.06^{a}	5.1±0.04^{b}	5.58±0.06^{a}
April	1408	7.04±0.05^{b}	822	6.53±0.06^{b}	5.87±0.04^{a}	5.38±0.06^{b}
May	1342	7.23±0.05^{a}	745	6.7±0.07^{ab}	5.83±0.05^{a}	5.43±0.06^{ab}

Means separated by different superscript letters under the same variable in one column are significantly different ($p<.05$).
*= significant ($p<0.05$), ***=significant ($p<0.001$), NS=Not significant, N =number of records.
A/ecology = Agro ecology, Lac/ month= lactation month, Lac/ phase = lactation phase
MMY= morning milk yield, EMY= evening milk yield

On the other hand, the highest morning and evening milk yield was obtained in parity 5 & 1 of Ardaita Holstein Friesian cows, but lowest value observed in parity 3 (Table 1). This result in close agreement with the previous report [12] Who observed that the milk production was lower in the 3rd than 1st and 2nd lactation stages (parity).

Morning and evening milk yield of monitored Holstein Friesian cows was significantly (Alage MMY and EMY, $p<0.001$; Ardaita MMY, $p<0.001$, EMY $p<0.05$) influenced by the respective lactation months. The significant effect of lactation months at different levels in the two different agro ecology could be due to the presence of minimal temperature fluctuation in the highland which makes the effect of lactation month low. In all cases the milk yield was significantly increased from March-May for Alage Holstein Friesian cows (Table 1). This could be due to the presence of high environmental temperature fluctuation at March than April and May influence the lactation milk yield.

Lactation milk yield (LMY): The overall least square mean and standard error of lactation milk yield of pure Holstein Friesian cows in the present study was 3078.51±54.74 kg with coefficient of variation 30.13%. Higher lactation milk yield were reported for Holestien Friesian cows in Ethiopia [9, 13]. Besides, higher values reported for Holstein Friesian cows in Tunisian [14] and in Sri Lanka [15], respectively. These lower LMY of Holstein Friesian cows in the present study compared to the literature results indicative of poor adaptation of this exotic breed to climatic and management conditions in Ethiopia. In contrast, lower lactation milk yield were reported in Pakistan and in Ethiopia [16,17].

The least square means and standard errors of lactation milk yield for the fixed effects of agro ecology, calving season, calving year and parity summarized in Table 2. The result indicated that calving season ($p<0.05$), calving year and parity ($p<0.001$) had significant effect on LMY, whereas agro ecology did not have significant effect ($p > 0.05$) on LMY of HF cows. Unlike the present study, the other reports found that agro ecological zones was significant ($p < 0.05$) source of variation for LMY of traditionally managed Sheko breed in Ethiopia [11]. This non-significant effect of agro ecology could be an indication that under intensive management system LMY highly dependent on management factors like health condition and feeding status of lactating cows in the farm.

Table 2: Least square means and standard error for lactation milk yield and lactation length on agro ecology, calving season, calving year and parity

	LMY(kg)		LL (days)	
Factor	N	LSM ±SE	N	LSM ±SE
Overall	475	3078.51±54.74	371	314.11±4.24
CV(%)		30.13		18.5
Agro ecology		NS		NS
Highland	169	3120.20±81.35	137	315.18±6.05
Lowland	306	3036.82±57.83	234	313.04±4.56
Calving season		*		*
Long rainy	146	2969.10±85.02^{b}	109	316.87±6.51^{ab}
Short rainy	175	3021.71±82.65^{ab}	139	302.53±6.17^{b}
Dry season	154	3244.72±79.21^{a}	123	322.93±6.01^{a}
Calving year		***		NS
2002	15	3179.45±236.05^{cadb}	11	313.91±18.01
2003	29	3410.62±183.35^{cab}	14	323.38±16.65
2004	13	3780.49±257.56^{ab}	6	331.80±24.21
2005	37	3836.67±154.85^{a}	18	320.29±13.92
2006	20	2806.59±203.11^{cdb}	16	303.38±14.88
2007	39	2780.32±148.08^{cd}	32	323.31±10.77
2008	32	2309.49±159.66^{d}	31	339.37±10.62
2009	38	2775.14±146.13^{cd}	33	299.66±10.30
2010	31	2897±162.07^{cdb}	30	294.39±10.79
2011	50	3242±128.64^{cab}	45	317.13±8.96
2012	53	3233.53±125.9^{cab}	47	310.37±8.70
2013	70	3144±109.49^{cdb}	62	303.09±7.72
2014	48	2625±129.44^{d}	26	303.09±11.61
Parity		***		NS
1	162	2746±75.07^{b}	126	325.09±5.69
2	125	2909±84.05^{ab}	95	311.32±6.40
3	82	3248±104.19^{a}	64	309.40±7.88
4	53	3185±130.44^{a}	40	309.57±9.90
5	24	3303.64±131.35^{a}	46	315.17±9.35

Means separated by different superscript letters under the same variable in one column are significantly different p<.05). ***=significant (p<0.001), *=(p<0.05), NS=Not significant, N =number of records.

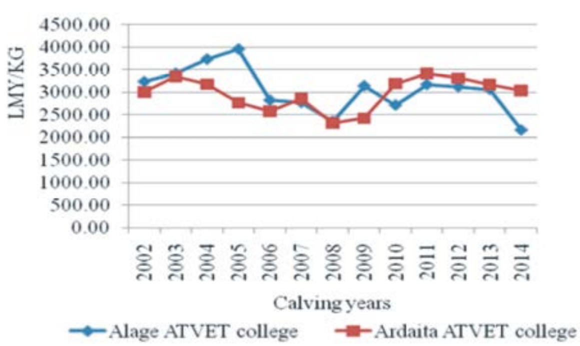

Fig. 2: The trend of LMY of Holstein Friesian cows over calving years at Alage and Ardaita College

Even in the tropics the influence of climatic conditions may be negligible under optimal feeding and management conditions [9]. Reasons to reduce heat stress, nutritional management programs such as total mixed rations (TMR), low quantity-high quality fiber rations and rations supplemented with necessary amino acids lead to increased cow comfort and productivity, ultimately increasing profits for dairy operations [19].

Similar to the current study significant effect of calving season reported on LMY of Holstein Friesian cows [13, 19]. In this study the cows calved in the dry season recorded highest LMY, while lowest LMY recorded from cows calved in main rainy season. This result is due to longer LL during the dry season in the present study is an indicative of highest milk yield recorded in the dry season. Besides to this, cows calved in the main rainy season further continued in the next dry season characterized by lack of succulence forages with low nutrient content, high fiber content, low digestibility and low voluntary intake by animals. Thus, when nutritional adequacy is decreased animals become low milk yield performer. The adaptability and performance of temperate breeds in the subtropics was not satisfactory, while the milk production was high in spring and fall indicating that environmental temperature was suitable for Friesian breed during these seasons [19, 20,]. Whereas, environmental deviations (heat stress in summer especially) coupled with fodder scarcity were the main reasons for low milk production.

Similar to the current finding, the significant (p<0.001) effect of calving year on LMY were reported for HF cows in Ethiopia [13]. In Alage dairy farm mean lactation milk yield was significantly increased from animals that calved in 2002-2005, dynamic decreasing trend from 2006-2008. Except during 2010,which showed a decreasing trend, LMY remains constant from 2009 -2013 and showed a decreasing trend at 2014 (Fig 2). The overall decreasing trend of LMY in Alage ATVET College might be due to poor management of animals and the influence of temperature fluctuation over the years. However, in Ardaita ATVET college, LMY showed an increasing trend during 2002-2003, a decreasing trend from 2004-2009 and moderate increasing trend from 2010-2014 (Fig 2). The increasing trend of LMY of Ardaita Holstein Friesian cows in the recent years could be due to the influence of temperature is negligible under highland condition and adaptation of the breed to the prevailing environment through time. Peak LMY were recorded in 2005 and 2011 in Alage and Ardaita, respectively; while lowest value was recorded in 2008 (Fig 2). Generally, the trend of lactation milk yield associated with calving year had no clear pattern (Fig 2). This inconsistent trend of calving year over LMY might be attributed to the inconsistent management practices across years and variability of climatic condition over the years and cows were not fed according to recommended amount. However, some progressively increasing trend observed in lactation milk yield over calving year is an indicative of improved management and adaptation of this breed to the prevailing environment through time [21]. Low performance of cows, which calved during 2008 could be related to unfavorable climatic condition and financial problems of the farm to avail sufficient feed due to regime change.

Similar to the present study, significant effect of parity was reported for crossbred and Holstein Friesian cows in Ethiopia [9, 13, 22]. The results of the current finding revealed that lactation milk yield seems linearly increasing from 1st to 5th parity. This increasing trend might be due to the increase in body weight combined with advancing age at full development of secretary tissues of the udder. However, the result found in the current study disagreed with the results reported for HF crosses in Sudan [23] and HF cows in Ethiopia [13]. They found that the increased trend in LMY up to third parity and decreased trend then after.

Lactation Length (LL): The overall least square mean and standard error of lactation length for pure Holstein Friesian cows in the current study was found to be 314.11±4.24 days with coefficient of variation 18.5% (Table 2). This result is in agreement with the LL of 302 days for crossbreed cows in Jimma town, Ethiopia [10]. The result found in this study was longer than the reports of previous authors [17,19, 24]. They observed that the average lactation lengths for Friesian cows were 252.25±5.31 days, 278.4±90.17 days and 291.86±6.55 days in Ethiopia and Pakistan, respectively. However, the LL obtained in this study was lower than 344 days lactation length of Friesian cows in India [25], 366.5±76.71 days under sub tropical conditions in China [26] and 362±13 days of Holestien Friesian in Ethiopia [9]. The value of LL reported in the present finding was advantageous to produce calves each year with a lactation period of about 10 and ½ months. Moreover, longer lactations prolong the calving interval thereby decreasing the number of calves that could be obtained during the life span of a cow.

The least square means and standard errors of LL for the fixed effects of agro ecology, calving season, calving year and parity are summarized in Table 2. The result showed that calving season had significant effect ($p<0.05$) on LL, where as agro ecology, calving year and parity had no significant effect ($P>0.05$) on LL. The significant effect of calving season on LL was in agreement with the previous authors reported for HF cows at Alage [27], for Fogera cattle at Andassa [28] and for Holstein Friesian cattle in Siri-lanka [29]. In contrast to the current finding, non-significant effect of calving season was reported for HF cows in Ethiopia [9] and in Uganda [30]. Longer LL for cows calved in dry season obtained in this study might be the cows were not allowed to dry off earlier at the dry season.

In contrary to the current finding the significant effect of agro ecology was reported on LL of traditionally managed Sheko cattle breeds [10]. This result indicated that agro ecology could not be the factor of LL of this breed group. Reasons to reduce heat stress, such as nutritional management programs as total mixed rations (TMR), low quantity- high quality fiber rations and rations supplemented with necessary amino acids lead to increased cow comfort and productivity, ultimately increasing profits for dairy operations [18].

Unlikely to the current finding, the significant effect ($p>0.05$) of calving year was reported for LL of HF cows [18, 27, 28]. Similar to the current finding the non-significant effect of parity was reported on LL of Holestien Friesian cows [9]. However, it disagreed with the significant effect of parity on LL for Holstein Friesian dairy cows [18, 22, 28, 29].

CONCLUSIONS AND RECOMMENDATIONS

Conclusions: In all aspects the milk yield was found to be higher in the morning than in the evening at both farms. The mean obtained for LL is within the normal that expected for modern dairy farm. The performance of Holstein Friesian cows on lactation milk yield is comparably low.

LMY and LL was not significantly ($P>0.05$) influenced by Agro ecology. Year of calving, parity ($P<0.001$) and season of calving ($p<0.05$) significantly influenced both LMY and LL. Due to this level of management between the two farms, difference between season of calving and year of calving and parity of cows might be some of the reason for this lower value of lactation milk yield in the study. The result therefore would provide very useful information and assist in decision making particularly regarding how to improve the low lactation milk yield of Holstein Friesian cows comprising different agro ecology for future production.

Recommendations: Low milk production of Holstein Friesian can be achieved by paying attention to management factors, especially improving the level of nutrition. Since calving years had shown to influence the performance of the existing breed, great attention should be given for the inconsistent management practice across the years.

In this study milk production performance were studied only on the dam side, other genetic and non genetic factor which may affect milk production performance including dairy traits such as conformation, udder structure and teat length as well as sex of calve and the effect of sire on performance of its offspring should be studied in the future.

Since data of cows in Ardaita dairy farm were not available from the start of dairying up 2000 G.C. Such un availability of data in these years limited the potential to evaluate the performance of cows from the data collected from 2000-2015. Therefore, more emphasis should be given for farm record keeping practice of Ardaita farm.

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REFERENCES

1. IGAD (Inter governmental Authority on Development), 2010. The contribution of livestock to economies of IGAD member states. IGAD Livestock Policy Initiative, working paper No. 02-10, 6-18.
2. Kumar Niraj and Tkui, 2014. Reproductive performance of crossbred dairy cows in Mekelle, Ethiopia. Scientific Journal of Animal Science, 3(2): 35-40.
3. CSA (Central Statistics Authority), 2009. Agricultural sample survey 2008/09. Report on livestock and livestock characteristics. Statistical bulletin 446. Addis Ababa. Ethiop, CSA.
4. FAOSTAT, 2009. FAO statistical year book. Rome, Food Agr. Organ. Unit. Nat.
5. MoA, 2012. Livestock growth strategy and action. Draft discussion paper. Addis Ababa: MoA. (Amharic version).
6. Lateef, M., K.Z. Gondal, M. Younas, M. Sarwary, M.I. Mustafa and M.K. Bashir, 2008. Milk production potential of pure bred Holstein Friesian and Jersey cows in subtropical environment of Pakistan. Pakistan Veterinary Journal, 28(1): 9-12.
7. National Meteorological Service Agency, 2010. Meteorological data, oromia, Ethiopia.
8. SAS 9.2, 2008. Statistical Analysis System Institute Inc., Kary, NC. USA.
9. Million Tadesse and Tadelle Dessie, 2003. Milk production performance of zebu, Holstein Friesian and their crosses in Ethiopia.
10. Belay Dugumma, Yisehak Kechero, Janssens GPJ, 2012. Productive and reproductive performance of zebu X Holstein-Friesian crossbred dairy cows in Jimma Town, Oromia, Ethiopia. Global Veterinaria, 8: 67-72.
11. Elias Bayou, A. Haile S. Gizaw and Y. Mekasha, 2015. Evaluation of non-genetic factors affecting calf growth, reproductive performance and milk yield of traditionally managed Sheko cattle in southwest Ethiopia.
12. Addisu Getu, Goshu Biru and Derb Arbse, 2015. crossbreeding effect on the performance of indigenous cattle: challenges and opportunities. Journal of agricultural science and food technology.
13. Million Tadesse, J. Thiengtham, A. Pinyopummin and S. Prasanpanich, 2010. Productive and Reproductive performance of Holstein Friesian dairy cows in Ethiopia. Livestock Research for Rural Development, 22(2).
14. Ajili, N., A. Rekik, Gara Ben and R. Bouraoui, 2007. Relationships among milk production, reproductive traits and herd life for Tunisian Holstein-Friesian cows. African Journal of Agricultural Research, 2 (2):047-051. http:// www.academicjournals.org/ajar/PDF/Pdf2007/Feb/Ajili%20et%20al..pdf.
15. Kollalpitiya, K.M.P.M.B., S. Premaratne and B.L. Peiris, 2012. Reproductive and Productive Performance of Exotic Dairy Cattle Breeds of Sri Lanka. Tropical.agri.research 23(4): 319–326.
16. Hyder, A.U. and S. Ullah, 2002. Effects of month and year of calving on 305-days milk yield in Holstein Friesian.
17. Haftu Kebede, 2015. Productive and Reproductive Performance of Holstein-Friesian Cows under Farmer's Management in Hossana Town, Ethiopia.
18. Bryan Scott Kennedy, 1999. Thermoregulation and the effects of heat stress on dairy cattle. Mississippi State University College of Veterinary Medicine.
19. Javed, K., M. Afzal., A. Sattar and R.H. Mirza. 2004. Environmental factors affecting milk yield in friesian cows in Punjab. Pakistan Vet. J., 24(2).
20. Javed, K., M. Afzal and I. Ahmad, 2002. Environmental effects on lactation milk yield of Jersey cows in Pakistan. J.Anim. Plant Sci., 12(3): 66-69.

21. Direba Hunde, Gabor Meszaros, Tadelle Dessie, Getnet Assefa, Million Tadesse and Johan Solkner, 2015. Milk yield and reproductive performance of pure Jersey dairy cattle in the Central Highlands of Ethiopia.
22. Kefena Iffa, B.P. Hegde and Tesfaye Kumssa, 2006. Lifetime Production and Reproduction Performances of *Bos taurus* x *Bos indicus* Crossbred Cows in the Central Highlands of Ethiopia. Eth. J. Anim. Prod. 6(2): 37-52.
23. Ahmed, M.K.A., A.B. Teirab, L.M.A. Musa and K.J. Peters, 2007. Milk production and reproduction traits of different grades of zebu x Friesian crossbreds under semi-arid conditions. Arch. Tierz., Dummerstorf, 50(3): 240-249.
24. Sattar, A., R.H. Mirza, A.A.K. Niazi and M. Lattif, 2005. Productive and reproductive performance of Holstein Friesian Cows in Pakistan. Research Institute for Physiology of Animal Reproduction, Bhunikey (Pattoki), Distt. Kasur, Pakistan-55300.
25. Juneja, I.J., N.S.R. Sastry and B.L. Yadav, 1991. Performance of purebred herd of Jersey and Holstein-Friesian cows in the semi-arid region. Indian J.Anim. Prod. Management, 7: 240-241.
26. Usman, T., G. Guo, S.M. Suhail, S. Ahmed, L. Qiaoxiang, M.S. Qureshi and Y. Wang, 2012. Performance traits study of Holstein Friesian cattle under subtropical conditions. Journal of Animal and Plant Sciences, 22(2 Suppl.): 92-95.
27. Fisseha Melaku, 2007. Reproductive and productive performance of Holstein Friesian cattle at Alage, Southern Ethiopia. MSc Thesis Alemaya University. Alemaya, Ethiopia.
28. Addisu, B., T. Mengistie, K. Adebabay, T. Getinet Asaminew, M. Tezera and Gebeyehu Goshu, 2010. Milk yield and calf growth performance of cattle under partial suckling system at Andassa Livestock Research Centre, North West Ethiopia. Livestock Research for Rural Development.22 (136). http:// www.lrrd.org/ lrrd22/8/bite22136.htm.
29. Krishantan, G. and J. Sinniah, 2014. Productive and Reproductive Performance of Holstein Friesian Cattle in the Hill Country of Sri Lanka.
30. Mulindwa, H.E., E. Ssewannyana and G.C. Kifaro, 2006. Extracted milk yield and reproductive performance of Teso cattle and their crosses with Sahiwal and Boran at Serere, Uganda. Uganda. J. Agri. Sci., 12(2): 36-45.