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A comparative study between Shami and Holstein cows for longevity and productive lifetime traits under subtropical conditions

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ABSTRACT

This study aimed to compare the longevity and productive lifetime traits between Shami and Holstein cows under subtropical conditions, in addition to assess the effect of age at first calving (AFC), first lactation milk yield (FLMY), year and season of first calving on the studied traits in both breeds. The available data included 495 records for Shami and 1129 records for Holstein from birth to disposal date during the period from 1982 to 2014.The studied traits were lifespan (LS), productive life (PL), cow efficiency index (CEI), number of calvings (NC), lifetime milk production (LMP), total lactation periods (TLP), lifetime daily milk production (LDMP), and total dry periods (TDP). The least squares means of LS, PL, CEI and NC were 96.3±1.80 months, 73.2±2.80 months, 64.9±0.008 % and 4.3±0.12 calving for Shami cows in respective order. The corresponding figures for Holstein cows were 66.1±1.81 months, 43.5±2.81 months, 56.4±0.012 % and 3.5±0.19 calving, respectively. The means of LMP, TLP, LDMP and TDP were 7713±563.38 kg, 787±33.43 days, 2.7±0.13 kg and 890±25.55 days for Shami cows and 14406±875.77 kg, 1049±51.96 days, 5.9±0.20 kg and 275±39.72 days for Holstein, respectively.The effect of breed was highly significant ($P<0.01$) on all studied traits. Cows for both breeds with AFC less than 24 months had more PL and NC. Also, cows with the highest average FLMY had the highest LMP, LDMP and TLP. It could be concluded that under the subtropical conditions, Shami cows exhibit superiority for longevity traits compared to Holstein ones.
Keywords: Dairy cows, Longevity, Productive lifetime traits, Syria

INTRODUCTION

Indigenous cows are characterized by low productive performance compared to Holstein ones (Belay *et al.,* 2012). However, indigenous cows play a pivotal role in the conservation of genetic biodiversity of ecosystems and increase the profit for small farmers due to their longer longevity traits, in addition to their adaptation to harsh environmental conditions especially during higher ambient temperatures and heat waves (Jonkus *et al.,* 2020). In context, Mekonnen *et al.*

(2020) indicated that Holstein cows reared in tropical and subtropical environments produced less milk yield by 40-60% than those reared in mild and comfortable conditions.

The number of cows in Syria reached one million heads, the majority of them are Holstein cows, whereas, the total number of Shami cows was close to one thousand head representing about 0.1 % of the total cattle population in Syria (Annual Agricultural Statistical Group, 2018). The Shami cows are characterized by high productive and reproductive performances, as well as high resistance to many diseases such as Brucella and foot and mouth diseases (Awad *et al.,* 2022).

Longevity and productive lifetime traits are considered the most crucial traits that influence the economic costs of dairy farms. The longevity traits of cattle are defined as the time from its birth date to the culling date (Dallago *et al.,* 2021). The natural lifespan of cattle may reach 20 years, but they were culled as much earlier than their expected life, due to their low milk production (Najafabadi *et al.,* 2016). Whereas, the actual productive life of dairy cattle ranges between 3 to 4.5 years (El Sabry and Almasri, 2022), moreover, the highest milk yield and related outcomes happen at the fifth and sixth parity (Horn *et al.,* 2012).

The intensive selection for milk yield in the Holstein breed reduces its longevity traits, increases the replacement costs, and increases its sensitivity to climate change and harsh environment compared to local breeds that characterized by their high adaptation to extreme conditions (Dallago *et al.,* 2021). Previous studies had been showed that longevity and productive lifetime traits are complex traits that affected by several factors such as age at first calving (Nilforooshan and Edriss, 2004), health (Shabalina *et al.,* 2020), conformation score (Miglior *et al.,* 2017), nutrition and management practices (Fuerst-Waltl *et al.,* 2018), and replacement heifers costs (Kamaldinov *et al.,* 2021).

The aims of this study were to compare the longevity and productive lifetime traits of Shami and Holstein cows under subtropical conditions; and to study the effect of breed, age at first calving (AFC), first lactation milk yield (FLMY), year and season of first calving on studied traits of Shami and Holstein cows.

MATERIALS AND METHODS

Ethical Statement

Ethical approval was not necessary for this study because the study did not involve direct animal handling and the data were obtained from an existing database in the governmental farms.

Data Collection

Data used in this study were collected from two Syrian stations during the period from 1982 to 2014. The first set of data was 495 records of Shami cows. The second set of data contained 1129 records of Holstein cows. Both stations are belonging to the Ministry of Agriculture and Land Reclamation, Syria. Each record included data of age at first calving, first lactation milk yield, lifespan, productive life, lifetime milk production, lifetime daily milk production, lactation periods, total drying periods and the number of calvings for each cow under study.

Herd Management

Cows in the two stations were kept under almost the same conditions. Cows were reared under a free housing system in semi-closed sheds. Cows were fed commercial concentrates (16 % protein), hay, and fresh green fodders whenever available. Roughages were provided to the cows twice a day. Water was available all the time.

For Shami heifers, natural services were done for the first time at age 18 months with more than 250 kg of body weight. Regarding Holstein cows, heifers were artificially inseminated at an average age of 13-15 months with a more than 350 kg of body weight. Rectal palpation was used to detect pregnancy in all cows after two months of insemination date. The machine milking was used in both stations twice daily. Milk yield was recorded twice monthly to calculate the monthly and the total milk production for each cow. The drying period for Holstein cows was about 60 days before calving, whereas Shami cows were dried spontaneously.

Studied Traits

The studied traits were calculated according to Sawa *et al.,* (2019) and Almasri *et al*., (2020) as follows:

1- The longevity traits:

1.1. Lifespan (LS, months) = disposal date – birth date.

2.1. Productive life (PL, months) = disposal date – first calving date.

3.1. Cow efficiency index (CEI, %) =productive life/lifespan *100.

4.1. Number of calvings (NL, calving) = total number of calvings during the productive life of a cow.

2- The productive lifetime traits:

1.2. Lifetime milk production (LMP, kg) = the cumulated total milk yield produced through the productive life of a cow.

2.2. Total lactation periods (TLP, days) = the sum of all full lactation periods during the cow's productive life.

3.2. Life daily milk production (LDMP, kg) = lifetime milk production per number of days during the total lactation periods.

4.2. Total dry periods (TDP, days) = the sum of all full dry periods during the cow's productive life.

Statistical Analysis

In order to determine the effect of breed, AFC, FLMY, and year and season of first calving on the longevity and productive lifetime traits, heifers were classified into five groups according to their average of AFC and FLMY depending on the standard deviation distribution of them. Analysis of variance was conducted using the General Linear Model (GLM) of XLSTAT 2020.3.1.27 software. The statistical model was as follows:

$$Y_{ijklmn} = \mu + B_i + A_j + T_k + R_l + S_m + e_{ijklmn}$$

Where:

Y_{ijklmn}: observation on the n^{th} animal for the studied traits,

μ : the overall mean,

B_i: the fixed effect of the i^{th} breed, (i=1, 2), where, 1=Shami cows and 2= Holstein cows,

A_j: the fixed effect of the j^{th} age at first calving (j=1, 2, 3, 4 and 5), where, 1<24, 2= 24–27.9, 3= 28–31.9, 4= 32–35.9 and 5≥ 36 months,

T_k: the fixed effect of the k^{th} first lactation milk yield (k=1, 2, 3, and 4), where, 1≤1200 kg, 2= 1200-1999, 3= 2000-2799 and 4≥2800 kg,

R_l: the fixed effect of the k^{th} year of first calving (l= 1, 2 and 3); where 1<1200, 2= 1200-1999, and 3= 2000-2799, and 4 ≥ 2800 kg.

S_m: the fixed effect of the m^{th} season of first calving (m= 1, 2, 3 and 4), where, 1= winter (December to February), 2= spring (March to May), 3= summer (June to August), and 4= autumn (September to November), and

e_{ijklmn}: random error assumed N I D (0, σ^2e).

RESULTS

The Longevity Traits

The results in Table (1) indicated that Shami cows had higher lifespan (LS), productive life (PL), cow efficiency index (CEI) and number of calvings (NC) than Holstein ones, and the differences were highly significant (P< 0.01). The PL and CEI were significantly affected by AFC. They were higher for cows of AFC <24 months. The LSM of PL and CEI were 60±4.53 months and 69.1±0.016 %, and then decreased gradually till reached 48.7±2.71 months and 52.6±0.014 % for cows had AFC ≥36 months.

The effect of FLMY on LS, PL and CEI was not significant. However, the FLMY affected significantly (p<0.01) NC. It was the highest (4.3 calving) for cows produced milk less than 1200 kg in their first lactation compared to those produced milk more than 1200 kg.

The LS, PL, CEI and NC were highly significantly affected (P< 0.01) by the year of the first calving (Table 1). It could observe that the means decreased gradually with progressing groups of the first calving. The analysis did not show any significant effect for the season of first calving on LS, PL, CEI and NC (Table 1).

The Productive Lifetime Traits

The results in Table (2) indicated that Holstein cows had higher lifetime milk production (LMP), total lactation periods (TLP), lifetime daily milk production (LDMP) and shorter total dry periods (TDP) compared to Shami ones.The TLP, LDMP and TDP were significantly affected by AFC. However, the LMP was not affected by AFC (Table 2). Cows calved for thefirst time at<32 months had higher LDMP, TLP, and shorter TDP compared to those calved for the first time at ≥ 32 months.

The effect of FLMY on all productive lifetime traits was highly significant (P<0.01). Cows had high FLMY produced the highest LMP, TLP and LDMP, and the shortest TDP compared to other cows (Table 2)

All productive lifetime traits (LMP, TLP, LDMP and TDP) were highly significant (P<0.01) affected by the year of first calving. However, the effect of the season of first calving on these traits was not significant except LDMP. The LDMP was lower (4.1 and 4.2 kg) in the summer and spring seasons compared to 4.4 kg in both winter and autumn seasons (Table 2).

DISCUSSION

The Longevity Traits

The significant results of Shami cows for lifespan, productive life, cow efficiency index and number of calvings compared to Holstein ones is due to that Shami cows had more ability to tolerate and adapt to Syrian subtropical environmental conditions. This result agrees with those of Gandini et al. (2007) who reported that the indigenous Reggiana cows had LS (71 months) and PL (48 months) longer than those of Holstein ones in Italy (65 and 38 months, respectively). The authors attributed that to the fertility traits which were better in indigenous Reggiana cows compared to those of Holstein, therefore, the Holstein cows were culled early.

Also, Cielava *et al.* (2017) found that the LS of Latvian indigenous Brown cows was 111 months longer than that of crossbred Holstein black and white cows (94 months). Moreover, Zhang *et al.* (2021) stated that the Holstein cows in China had shorter PL (27 months). This is due mainly to the intense genetic improvement in milk production of Holstein cows which adversely affected the longevity traits. Garcia-Peniche *et al.* (2006) reported that the CEI was significantly affected by breed. The CEI for Jersey cows (48.2 %) was higher than that of Holstein ones (45.9 %) in US.

The significant effect of AFC on both PL and CEI is due to that cows calved for the first time early started their PL early compared to those calved lately, in addition, cows calved lately had poor reproductive and productive performance, so they were culled early. These results agree with those of Morales *et al.* (2017) on Retinta cows in Spain, Török *et al.* (2021) on Hungarian Holstein and Medina *et al.* (2022) on Honduras Holstein cows.

Conversely, Adamczyk *et al.* (2017) found that Holstein cows calved for the first time at < 24 months had a shorter PL (64.8 months) compared to those calved lately at > 31 months (70.8 months). Also, Valchev *et al.* (2020) indicated that Bulgarian Holstein cows calved for the first time at ≤ 24 or ≥ 37 months had the shortest PL (48.4 and 46.8 months, respectively), whereas, the PL was the highest (58 months) when the AFC for those cows ranged from 28 to 30 months. The authors attributed that heifers at this age have appropriate mature and fit body condition score for life. On the other hand, Vukasinovic *et al.* (2001) and Niforooshan and Edriss (2004) indicated that the PL was not significantly affected by AFC for Switzerland cows and Holstein cows in Iran, respectively.

However, the insignificant effect of AFC on LS and NC is in accordance with those of Mészáros *et al.* (2008) on Slovak Pinzgau cows and Morales *et al.* (2017) on Retinta cows in Spain, who did not find any significant effect of AFC on LS. Conversely, Cooke *et al.* (2013) and Török *et al.* (2021) indicated that Holstein cows in the UK and Hungary had significantly the longest LS when they calved for the first time

Table 1.Least squares means and their standard errors (LSM±SE) of longevity traits

Classification[1]	Number of records	Lifespan (LS, months)	Productive life (PL, months)	Cow efficiency index (CEI, %)	Number of calvings (NC, calving)
Breed		**	**	**	**
Shami	495	96.3^{b}±1.80	66.1^{b}±1.81	64.9^{b}±0.008	4.3^{b}±0.12
Holstein	1129	73.2^{a}±2.80	43.5^{a}±2.81	56.4^{a}±0.012	3.5^{a}±0.19
Age at first calving (AFC, months)		**NS**	**	**	**NS**
<24	32	82.5±4.51	60.0^{b}±4.53	69.1^{e}±0.016	4.1±0.30
24-27.9	769	85.0±1.86	58.6^{b}±1.87	64.1^{d}±0.012	4.1±0.13
28-31.9	544	84.8±1.60	55.5^{b}±1.61	61.0^{c}±0.011	3.9±0.11
32-35.9	177	84.7±2.28	51.2^{a}±2.29	56.4^{b}±0.014	3.7±0.15
≥36	102	86.9±2.70	48.7^{a}±2.71	52.6^{a}±0.014	3.6±0.18
First lactation milk yield (FLMY, kg)		**NS**	**NS**	**NS**	**
<1200	260	90.1±3.85	60.3±3.86	62.2±0.016	4.3^{b}±0.26
1200-1999	168	82.4±2.85	52.4±2.86	59.6±0.012	3.9^{ab}±0.19
2000-2799	131	82.2±2.33	52.2±2.33	59. 8±0.010	3.7^{a}±0.16
≥2800	1065	84.2±2.41	54.3±2.41	61. 0±0.010	3.6^{a}±0.16
Year of first calving (groups)		**	**	**	**
1982-1992	397	90.1^{c}±1.91	60.3^{c}±1.92	62.4^{b}±0.008	4.2^{b}±0.13
1993-2002	623	86.4^{b}±1.77	56.4^{b}±1.78	61.5^{b}±0.008	4.0^{b}±0.12
2003-2014	604	77.9^{a}±1.99	47.8^{a}±2.00	58.0^{a}±0.008	3.4^{a}±0.13
Season of first calving		**NS**	**NS**	**NS**	**NS**
Winter	428	84.7±1.96	54.8±1.96	60.7±0.008	3.9±0.132
Spring	361	84.7±2.00	54.7±2.00	60.6±0.008	3.8±0.135
Summer	418	84.8±1.95	54.8±1.96	60.6±0.008	3.8±0.131
Autumn	417	84.9±1.99	54.9±2.00	60.6±0.008	3.9±0.134

[1]Within each classification, means not followed by the same letter differ significantly at the 5 % level; Total number of records = 1624; ** (P< 0.01); NS = not significant

early (< 26 months), compared to those calved lately (more than 28 months). While, Kalińska *et al.* (2019) and Valchev *et al.* (2020) reported that the Holstein cows in Poland and Bulgaria that calved for the first time at < 24 months had the shortest LS (56 and 73 months, respectively) compared to 67.2 and 88 months, respectively for those calved for the first time at >30 months. Moreover, Froidmont *et al.* (2013) and Medina *et al.* (2022) reported that the Holstein cows in Belgium and Honduras that calved for the first time lately at > 38 months had significantly the longest LS (81.5 and 120 months, respectively) compared to 72.3 and 73 months for those calved earlier (<30 months).

The significant effect of FLMY on NC may be due to the negative correlation between milk production and fertility. This result agrees with that of Sawa and Bogucki (2017) who indicated that the Holstein cows produced milk yield between 7001 and 9000 kg in their first parity had the highest NC (3.09) compared to other ones that produced more than 9000 kg. Conversely, Sawa and Krezel-Czopek (2009) did not find any significant effect for FLMY on NC in Polish Holstein cows.

The non-significant effect of FLMY on LS, PL and CEI agrees with those of Brzozowski *et al.* (2003) for Polish cows and Petrović *et al.* (2019) on Simmental breed in Serbia. On the other hand, Haworth et al. (2008) reported that dairy cows produced less than 30 liters of milk/ day in the first lactation had longer LS. Also, Jankowska *et al.* (2014) indicated that Polish Holstein cows produced <5000 to 10000 kg of milk in their first lactation and had longer LS (63 months) than those produced< 5000 or > 10000 kg of milk in the first lactation, where their LS was 59.4 and 53.2 months, respectively. They attributed to cows that produced high milk yield in the first lactation had poor reproductive performance, thus they were culled early and their LS was shorter. Whereas, Marinov *et al.* (2020) reported that the Bulgarian Holstein cows had

Table 2. Least squares means and their standard errors (LSM±SE) of productive lifetime traits

Classification[1]	Lifetime milk production (LMP, kg)	Total lactation periods (TLP, days)	Lifetime daily milk production (LDMP, kg)	Total dry periods (TDP, days)
Breed	**	**	**	**
Shami	7713^{a}±563.38	787^{a}±33.43	2.7^{a}±0.13	890^{b}±25.55
Holstein	14406^{b}±875.77	1049^{b}±51.96	5.9^{b}±0.20	275^{a}±39.72
Age at first calving (AFC, months)	**NS**	**	**	**
<24	10969±1412.62	956^{ab}±83.82	4.6^{b}±0.32	729^{c}±64.07
24-27.9	11833±583.36	977^{b}±34.61	4.6^{b}±0.13	604^{bc}±26.46
28-31.9	11256±501.64	942^{ab}±29.76	4.3^{ab}±0.11	567^{ab}±22.75
32-35.9	10470±715.46	875^{a}±42.45	3.9^{a}±0.16	514^{a}±32.45
≥36	10771±844.79	842^{a}±50.13	3.9^{a}±0.19	497^{a}±38.31
First lactation milk yield (FLMY, kg)	**	**	**	**
<1200	10980^{a}±1204.46	913^{ab}±71.47	3.6^{a}±0.27	714^{c}±129.53
1200-1999	9219^{a}±892.54	833^{a}±52.96	3.8^{a}±0.20	589^{bc}±60.24
2000-2799	10149^{a}±728.57	885^{a}±43.23	4.1^{a}±0.17	552^{ab}±43.66
≥2800	13891^{b}±753.33	1042^{b}±44.70	5.6^{b}±0.17	473^{a}±43.66
Year of first calving (groups)	**	**	**	**
1982-1992	11410^{b}±597.95	977^{b}±35.48	4.1^{a}±0.136	678^{c}±27.12
1993-2002	11494^{b}±554.20	993^{b}±32.88	4.3^{a}±0.126	574^{b}±25.13
2003-2014	10275^{a}±622.82	785^{a}±36.96	4.5^{b}±0.142	495^{a}±28.25
Season of first calving	**NS**	**NS**	**	**NS**
Winter	11585±612.66	932±36.35	4.4^{b}±0.140	582±27.79
Spring	10859±625.32	915±37.10	4.2^{a}±0.143	586±28.36
Summer	10603±610.11	908±36.20	4.1^{a}±0.139	579±27.67
Autumn	11192±623.60	918±37.0	4.4^{b}±0.142	581±28.28

[1]Within each classification in the same column means followed by different letters differ significantly; ** (P< 0.01); NS = not significant

FLMY up to 4000 kg and more than 10000 kg had the shortest PL (32.4 and 33.6 months, respectively) compared to 36 months for those had FLMY around 4000-8000 kg milk. The authors observed that cows with low FLMY were culled early. The reported tendency for shorter PL of cows with very high FLMY of more than 10000 kg is an indicator of exhaustion of young cows with high first lactation productivity.

Also, the significant effect of periods of the year of first calving on LS, PL, CEI and NC may be due to the differences in management practices from one period to another. These results are in the same line with Sawa and Bogucki, (2010) on Holstein cows in Poland, Froidmont *et al.* (2013) on Holstein cows in Belgium, and Singh *et al.* (2018) on crossbred cows (Friesian × Sahiwal) in India.

The uneffect season of the first calving on all longevity traits could be due to the resemblance of feedstuffs in their quality and quantity as well as may be due to the uniform management practices among different seasons. This result is in accordance with those of Salem and Hammoud (2019) on Friesian cows in Egypt, Froidmont *et al.* (2013) on Holstein cows in Belgium, and Kučević *et al.* (2020) on Serbian Holstein cows. On the other hand, Petrović *et al.* (2019) observed that season significantly affected CEI. It was the highest (59.49 %) in summer season and the lowest (57.31 %) in autumn one.

The Productive Lifetime Traits

The superiority of Holstein cows over Shami ones for LMP, LDMP, and TLP with shorter TDP is due to that Holstein cows were exposed to an intensive genetic selection, which increased their productive performance compared to Shami cows, which were not subjected to any genetic improvement program. These results were confirmed by Cielava *et al.* (2017) who found that the black and white Friesian cows had LMP (37916 kg) and LDMP (13.2 kg) more than those of native Brown cows in Latvia (35188kg and 10.4 kg, respectively).

The significant effect ($P<0.01$) of AFC on TLP, LDMP and TDP agrees with that of M'hamdi *et al.* (2010) who observed that Holstein cows in Tunisia that calved early had the longest TLP compared to those calved lately. Also, Sung *et al.* (2016) found that Holstein cows of AFC between 24 and 28 months had longer TLP (1143 days) than those calved either at < 24 months (1046 days) or > 28 months (1111 days) in Korea. Regarding the LDMP, Sawa *et al.* (2019) found that the Holstein cows that calved early at ages between 24.1 and 26 months had significantly higher LDMP (21.9 kg) than those calved at ages more than 32 months (19.5 kg) in Poland. Also, Eastham *et al.* (2018) found that cows had AFC around 22 months produced higher LDMP (15.2 kg) than those of 36 months AFC (12.8 kg) in the UK. Kalińska *et al.* (2019) indicated that the Polish Holstein cows that calved for the first time between 24 to 27.9 months had the highest LDMP (9.1 kg) compared to 7.8 kg for those calved for the first time at > 29.9 months.On the other hand, Salem and Hammoud (2019) indicated that the LDMP was not significantly affected by AFC in Friesian cows in Egypt.

There is no significant differences for LMP among cows that calved in different AFC; however, the cows that calved at AFC between 24-31.9 months had the greater LMP. This result agrees with that of Kučević *et al.* (2020) for Holstein cows in Serbia. Conversely, Froidmont *et al.* (2013) reported that Holstein cows in Belgium that calved for the first time at 22-26 months produced significantly the highest LMP (29340 kg) compared to the other ones that calved lately. Also, Teke and Murat (2013) found that the highest LMP was observed when the AFC was 23 months and the lowest LMP was recorded when the AFC was less than 21 months, or more than 43 months of Holstein cows in Turkey and the differences were significant. In Korea, Sung *et al.* (2016) found that Holstein cows of AFC ranged between 24-28 months produced 34000 kg LMP higher than those calved either < 24 months (32000 kg) or > 28 months (33000 kg) and the difference was significant. Also, Hutchison *et al.* (2017) reported that the cows had AFC < 24 months had significantly higher

LMP (25184 kg) than those of 20783 kg for the cows had AFC > 30 months.

Sawa *et al.* (2019) reported that Holstein cows with AFC between 22.1-26 months produced LMP> 25 000 kg which was significantly higher than that of 19095 kg for the cows with AFC > 32 months. Medina *et al.* (2022) found that the Holstein and Brown Swiss cows in Honduras that calved early at < 30 months scored the highest LMP (14290 kg and 15979 kg, respectively) compared with those calved lately (> 42 months),whereas the values were 10840 kg and 10411 kg, respectively, and the differences were significant. Kalińska *et al.* (2019) indicated that Polish Holstein cows that calved for the first time at the age < 24 and > 28 months had significantly the lowest LMP; however, the cows that calved between 24 and 28 months produced the highest LMP.

The effect of FLMY on LMP, LDMP, TLP and TDP was highly significant. This is due to that the cows started their productive life with high FLMY, achieved better productive performance through their subsequent lactations till culled from the herd. These results agree with those of Tekerli and Koçak (2009) on Holstein cows under subtropical conditions, Sawa and Krezel-Czopek (2009) on Holstein Friesian cows in Poland, and Musingi *et al.* (2022) on Sahiwal cows in Kenya.

The significant effect of year of the first calving on productive lifetime traits in this study may be due to variations in management policies and environmental conditions through different years. These results agree with those of Berihulay and Mekasha (2016) on Holstein Friesian cows in Ethiopia, Froidmont et al. (2013) on Holstein cows in Belgium, Petrović *et al.* (2019) on Simmental cows in Serbia, and Manzi *et al.* (2020) on the Ankole cow and Ankole crossbred cows of Rwanda.

Additionally, the effect of the season of first calving on all productive lifetime traits was not significant except on LDMP. This is due to there were no differences in feedstuff and climate conditions among different season. Whereas, the significant effect of the season of first calving on LDMP may be attributed to the cows calved in winter and autumn having high LMP and NC. This result agrees with that of Berihulay and Mekasha (2016) on Holstein cows in Ethiopia. Conversely, Froidmont *et al.* (2013) reported that Holstein cows in Belgium that calved for the first time during the spring season produced significantly the lowest LMP (26243 kg); however, the highest LMP (27705 kg) was recorded during the summer season. Also, Kučević *et al.* (2020) indicated that the effect of the season of first calving on LDMP was not significant on Serbian Holstein cows. However, in India, Singh and Singh (2016) reported that Sahiwal cows that calved in summer had lower TLP (1471 days) than those cows that calved in winter (1602 days).

CONCLUSION

It could be concluded that under the subtropical environmental conditions, Holstein cows are more sensitive to high ambient temperatures and harsh environments compared to Shami cows. Therefore, Holstein cows may have lower values for lifespan, productive life, cow efficiency index, and number of calvings compared to Shami cows. Consequently, Shami cows are considered promising local genetic resources that could guarantee more economic efficiency and suitability in the long term than Holstein cows, especially for smallholder farmers. Thence, Shami cows should be subjected to sustainable genetic improvement for their productive and reproductive performance along with the suitable management practices.

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CONFLICT OF INTEREST

There are no conflicts regarding the publication of this manuscript.

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