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A Study on Milk Yield, Fertility and Milk Quality Characteristics of Primiparous Red-Holstein and Holstein-Friesian Cows

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ABSTRACT

The aim of this study was to determine the reproductive characteristics, milk yield and milk quality of Primiparous Red-Holstein (RH) and Holstein-Friesian (HF) cows. For this aim, records and monthly taken milk samples of 83 RH and 14 HF raised on a farm in Aydın, Turkey were used. The averages of the first calving age (FCA), gestation length (GL), days open (DO), calving interval (CI), daily milk yield (DMY), 305-day milk yield (305-dMY), solid non-fat (SNF) and Log_{10} somatic cell count (Log_{10}SCC) of milk were found to be 27.6±0.24 mo, 278.4±1.09 d, 144.0±7.12 d, 421.4±7.66 d, 22.7±0.21 kg, 6981±137.0 kg, 9.8±0.04% and 4.59±0.024 (38905 cells/ml), respectively. Except for DMY, the differences between the breeds were statistically insignificant for FCA, GL, DO, CI, 305-dMY, SNF and Log_{10}SCC. DMY averages for RH and HF were 21.8±0.21 kg and 24.3±0.49 kg, respectively. The effect of season on FCA and the effect of lactation month on SNF and Log_{10}SCC were also found to be statistically significant. Apart from DMY, not any significant difference was observed between RH and HF breeds in terms of the characteristics emphasized.

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İlk Laktasyondaki Kırmızı-Alaca ve Siyah-Alaca Sığırlarda Süt ve Döl Verimi ile Süt Kalite Özellikleri Üzerine Bir Araştırma

MAKALE BİLGİSİ

Araştırma Makalesi

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ÖZ

Bu çalışmanın amacı Kırmızı-Alaca (KA) ve Siyah-Alaca (SA) süt sığırlarında döl ve süt verimi ile süt kalite özelliklerinin belirlenmesidir. Bu amaçla Aydın'da bir işletmede yetiştirilen ilk laktasyondaki 83 baş KA ve 14 baş SA sığıra ait kayıtlar ve aylık olarak alınan süt örnekleri kullanılmıştır. İlkine buzağılama yaşı (İBY), gebelik süresi (GS), servis periyodu (SP) buzağılama aralığı (BA), günlük ortalama süt verimi (GOSV), 305 günlük süt verimi (305-gSV), yağsız kuru madde oranı (YKMO) ve Log_{10} somatik hücre sayısı (Log_{10}SHS) ortalamaları sırasıyla 27,6±0,24 ay, 278,4±1,09 gün, 144,0±7,12 gün, 421,4±7,66 gün, 22,7±0,21 kg, 6981±137,0 kg, %9,8±0,04 ve 4,59±0,02 (38905 hücre/ml) olarak hesaplanmıştır. GOSV dışında ırklar arasında İBY, GS, SP, BA, 305-gSV, YKMO, Log_{10}SHS bakımından önemli bir farklılık saptanmamıştır. KA ve SA ırklarına ait GOSV ortalaması sırasıyla 21,8±0,21 kg ve 24,3±0,49 kg olarak belirlenmiştir. İBY üzerine doğum mevsimi, YKMO ve Log_{10}SHS üzerine laktasyon ayı etkisi önemlidir. İlk laktasyondaki SA ve KA ırkları arasında GOSV dışında üzerinde durulan özellikler bakımından önemli bir farklılık saptanmamıştır.

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Introduction

Cattle was domesticated about 10-12 thousand years ago to benefit from the pulling power in field agriculture, and it made the important contributions to humanity with milk, meat and leather productions. In recent years, one of the preferred breeds by Turkish dairy cattle farmers have been Red-Holstein (RH) and the number of studies conducted on the yield characteristics and milk quality of this breed in Turkey is very limited.

RH, which has recessive homozygous (rr) in terms of color gene, are red and white in color. The USA, Canada and some European countries formed a separate pedigree for RH and accepted it as a separate breed from Holstein-Friesian (HF) in the 1950s (Yılmaz, 2010).

In studies on fertility characteristics of RH breed in the conditions of Turkey, the average first calving age (FCA) was reported to be 851.6±6.19 d (28.4 mo, n=181) by Koc et al. (2011), 874.8±13.72 d (29.2±0.32 mo; n=316) by Koç et al. (2017) and 842.4±21.04 d (28.1 mo, n=38) by Koç (2017a). No studies on DO average have been found in the conditions of Turkey. The mean of calving interval (CI) for RH was reported to be 445.3±4.69 d (n=322) by Koç et al. (2011) and 443.0±4.90 d (n=286) by Koç (2012). Mean GL of the breed was reported as 278.8±0.28 d (Koç et al., 2011).

Milk yield mean obtained per milking of the breed was reported between 9.8±0.46 kg and 12.2±0.46 kg by Yılmaz (2010), 11.6±0.22 kg in morning milking and 10.2±0.21 kg in evening milking by Koç (2015) and 12.8±0.01 kg and 11.1±0.01 kg for morning and evening milking respectively by Koç (2017b). The average 305-dMY of the breed was also reported as 7652.8±80.68 kg (Yılmaz, 2010).

In the studies on milk quality characteristics of the breed, Yılmaz (2010) reported SNF as 8.9±0.07%, Koç (2015) determined 8.6±0.04% and 8.6±0.04% in the morning and evening milking, respectively.

In a study conducted by Koç (2015) in a RH herd in Aydın, Turkey, from 449 samples taken in the morning and 442 samples taken in the evening milking, the means of SCC were determined as 91833 cells / ml and 100462 cells / ml, respectively. In the same study, the SCC mean of the breed in the first lactation was 54702 cells / ml and lower than all other parities.

In this study, the fertility, first lactation milk yield and milk quality characteristics of HF and RH which have been preferred as an alternative to HF breed in recent years, brought from Germany to a farm in Koçarlı commune of Aydın, Turkey, were investigated.

Material and Method

The animal material of the study consisted of 83 RH and 14 HF cows in the first lactation, which were brought from Germany in 2015 and calved in late 2015 and early 2016 in a dairy cattle farm located in Cincin county of Koçarlı commune, Aydın, Turkey. In addition to the fertility and milk yield records, milk samples were collected from these cows 10 times for one visit per month at milking times. In this study, only the data of the cows in the first lactation were used.

By using the records of the cattle in the establishment and the records of Aydın Cattle Breeders Association, information such as birth date, insemination date, calving date belonging to the animals were obtained, and FCA, GL, DO and CI characteristics of the animals were determined.

Records of milk yield of cows were provided by visiting the farm once a month (one month at the morning milking, the next month at the evening milking). Daily milk yield (DMY) was calculated by multiplying the amount of milk given by the animal during the operation visit by two (Kumlu, 2008). Using these yields, 305-dMY of the cows were calculated according to Holland method (Gönül, 1971).

Milk samples were taken before milking after the pre-stimulation of the udder, and 2-3 strips of milk from each teat were milked and then the milk samples were taken in 50 ml plastic tubes and kept in an iced box before analysis. The samples were analyzed to determine the SNF and SCC at ADU Faculty of Agriculture, Department of Animal Breeding and Improvement Laboratory. SNF was determined with a refractometer (FG-103 Brix 0-32%). For SCC analysis, Direct Microscopic Somatic Cell Counting Method was used. By using a micropipette, 10 µl milk spreads on a strip area of 1 cm^2 on a slide and kept until spread milk dried to fix the cells. The cells were colored with a methylene blue colorant and before counting the cells, the slide was dried and washed with water to take out the excess of colorant.

Statistical Analysis

All cows were almost at the same lactation period because they calved in late 2015 and early 2016 and the number of cows from both breeds were enough to be compared. Since the number of HF cows is not very large, the effects of individual differences regarding the traits emphasized on the average might be high. In order to ensure homogeneity of variance in SCC data, values were transformed using ten base logarithms (Log_{10}) before statistical analysis.

In the statistical analysis of the data, SAS (1999) package program was used and the differences between the groups were determined according to Tukey (P<0.05) multiple comparison test. The following statistical model was used in the analysis of FCA, DO, CI and 305-dMY:

$$y_{ijk} = \mu + a_i + b_j + e_{ijk} \quad (1)$$

Where;

- y_{ijk} : Observed value of the trait,
- μ : overall mean,
- a_i : breed effect (i=RH and HF)
- b_j : Birth season effect for FCA (j= spring, summer and autumn, there was not any record for winter), calving month effects for DO and CI (j=8., 9., and 12. mo), FCA group effects for 305-dMY (j= <24 mo, 24-27 mo, 28-30 mo and >30 mo)
- e_{ijk} : Random error.

For the statistical analysis of GL, the following model was used:

$$y_{ij}= \mu + a_i + e_{ij} \quad (2)$$

Where;
y_{ij} : Observed value of the trait
μ : Overall mean, a_i: breed effect (i=RH and HF)
e_{ij} : Random error.

For the statistical analysis of DMY, SNF and SCC, the following model was used:

$$y_{ijk}= \mu + a_i + b_j + (ab)_{ij} + e_{ijk} \quad (3)$$

Where;
y_{ijk} : Observed value of the trait
μ : Overall mean
a_i : Breed effect (i=RH and HF)
b_j : Lactation month effects (j= 1, 2, ….., 11)
$(ab)_{ij}$: Breed x lactation month interaction effects
e_{ijk} : Random error.

Results and Discussion

Fertility Traits

First calving age (FCA): The breed effect on FCA was insignificant (P>0.05), however the effect of birth season was important (P<0.01). FCA means for RH and HF were 832.3±4.82 d and 818.8±11.14 d, respectively (Table 1). For the spring, summer and autumn, the averages of FCA were calculated as 913.4±10.04 d, 825.8±7.02 d and 737.4±9.38 d, respectively, and the differences between all birth seasons were important (P<0.01).

While FCA average of animals born in autumn was 176 days shorter than those born in the spring, the animals born in the summer had 87.57 days shorter FCA than those born in the spring, and 88.43 days longer than those born in autumn (P<0.01).

FCA average of the animals born in autumn was 24.58 mo, which was considered ideal as 24-25 mo. This value showed that the animals were inseminated at an age of about 15 mo. However, it was understood that the animals born in the spring and summer months conceived by being inseminated at the age of approximately 21 mo and 18 mo, respectively. Since these animals were brought being heifers from Germany, it was understood that the animals could not reach the desired live weight at the age of 15-16 mo and therefore, their first insemination was delayed considering that the animals were mainly grazed on pasture.

In this study, the average FCA found for RH breed (832.3±4.82 d) was about 15 days higher than the result reported by Koç (2017a) for the same breed, and the average of 818.8±11.14 d obtained in this study for HF breed was 23.7 days shorter than the result reported by the same author.

The averages of FCA for HF and RH breeds found in this study were shorter than the results reported by Perez et al. (1986) for HF, Speignt and Fairline (1987) for HF, Gyawu et al. (1990) for HF, Şekerden et al. (1989) for HF, Koç (2011) for HF and Montbeliarde breeds, Koç et al. (2011) for RH, Koç (2016) for RH and SIM breeds and Koç et al. (2017) for HF, RH and Simmental (SIM) breeds, but very close to the results of Nenadovic et al. (1987) for HF and Koç (2001) for HF. Similarly, to this study, Koç et al. (2011) reported about one month longer FCA in summer born animals than those born in winter.

Gestation Length (GL): GL mean values of RH and HF are given in Table 2. GL means of the breeds were 278.22±1.189 d and 279.38±2.911 d, respectively and the difference between the breeds was not significant (P>0.05). In this study, the GL means for RH and HF breeds were higher than the average reported by Duranlı (2008) for HF breed (285.1±1.66d), and similar to the average (278.8±0.28 d) reported by Koç et al. (2011) for RH.

Days Open (DO) and Calving Interval (CI): The effects of breed and calving month on DO and CI were insignificant (P>0.05). DO values of RH and HF ranged from 36 d to 373 d, with an overall average of 144.0±7.12 d. CI values changed between 319 d and 646 d and the average was calculated as 421.4±7.66 d (Table 3).

The means of DO for RH and HF breeds were 136.3±10.33 d and 127.6±21.54 d, and the means for CI were 409.1±10.95 d and 409.1±23.46 d, respectively. According to the calving month, the shortest DO average was obtained for August with 109.4±35.79 d, while the longest was obtained for October with 158.6±12.7 d. The difference of 49.19 d between these two months was insignificant (P>0.05). While DO average showed a steady increase from August to October, it decreased from October to December.

A similar situation was observed for CI trait. The average CI, which was 380.5±37.98 d in August, increased to 442.0±13.97 d in September and decreased to 397.0±31.72 d in December. The 61.5 d difference between the lowest CI average in August and the highest in October was statistically not significant (P>0.05).

In this study, the means of DO found for RH (136.3±10.33 d) and HF (127.6±21.54 d) were longer than the results reported for HF breed by Özçelik and Arpacık (2000), Duru and Tuncel (2002a), Türkyılmaz (2005), Juozaitiene and Juozaitis (2005), similar to the results reported for HF cows born in Turkey but shorter than HF cows brought from Italy as stated by Uzmay et al. (1998), and similar to the means of the fourth and sixth parities but, longer than the other parities reported for HF by Yaylak (2003).

When the situation for CI trait was evaluated, CI means for RH (409.1±10.95 d) and HF (409.1±23.46 d) found in this study were shorter than the results reported for HF (391.8±1.45 d) by Koç (2001), for HF (399.6±5.93 d) and Montbeliarde (391.6±5.75 d) breeds by Koç (2011), for RH (445.3±4.69 d) by Koç et al. (2011), and for RH (443±4.9 d) by Koç (2012).

In this study, it can be interpreted that DO and CI averages calculated for RH and HF breeds were longer than the ideally accepted periods. The owner of the farm might let delay the insemination of the cows because they were in the first lactation and thus their growth continued.

Milk Yield and Quality Traits

Daily Milk Yield (DMY): DMY values of RH and HF breeds varied between 4.7 kg and 36.6 kg, with an overall average of 22.7±0.21 kg. The effects of breed and lactation month on DMY were statistically significant (P<0.01), but the interaction effect of breed x lactation month was insignificant (P>0.05). DMY averages of HF and RH were found to be 24.3±0.49 kg and 21.8±0.21 kg, respectively.

The difference of 2.5 kg found between breeds was statistically significant (P<0.01). DMY averages of the second, third and fourth lactation months was above 26.0 kg. After the fifth month, the average decreased gradually towards the end of lactation, and the value in the last month was 15.7±0.99 kg (Table 4).

It is known that while their persistency is high, the cows at the first parity produce lower milk than the cows at higher parities. The lower milk yield drop rate found for the animals in this study may be attributed to their first lactation, in other words, their higher persistency rate.

The DMY averages found in this study for HF and RH breeds were higher than the means reported by Koç (2008a) for HF and by Koç et al. (2009) for HF and RH. In this study, since milk measurement is made as alternate, one month in the morning and the next month in the evening, when half of DMY average is accepted as inspection time milk yield (ITMY), the averages for HF and RH breeds can be calculated as 12.1 and 10.9 kg, respectively. In this case, ITMY obtained for HF breed is lower than the average reported by Koç (2007a), and higher than the values reported by Koç (2007b) and by Koç (2011) for HF breed.

In this study, the average ITMY calculated for RH (10.9 kg) was lower than the average reported by Yılmaz (2010) for RH cows in the morning milking in winter and in the morning and evening milking times in summer, however, it was higher than the average obtained in the evening milking in winter (9.9±0.46 kg), and higher than the values reported by Koç (2017b) for RH in the morning and evening milking times.

Also, in this study, the average ITMY calculated for RH was lower than the values reported for the first lactating cows of RH (11.2±0.25 kg) by Koç (2015). The average ITMY calculated in this study for both RH and HF breeds were higher than the values reported for Montbeliarde cows by Koç (2007a), for Brown-Swiss (BS) cows by Koç (2007b), and for Montbeliarde cows reported by Koç (2011).

In this study, both DMY and ITMY averages obtained for HF and RH breeds were lower than the averages reported for the same breeds in some other studies conducted in the same region before, because all the cows in this study were at the first lactation, as a result of that, they produced physiologically less milk than the cows at higher parities.

The changes of DMY for RH and HF breeds according to the lactation months are given on Figure 1. As seen on the figure, except the second lactation month, in all month's HF breed had a higher DMY than RH breed. In both breeds, the mean DMY also decreased significantly in the 9th, 10th and 11th months because they were at the late stage of lactation.

Table 1. The first calving age (FCA) least squares means and standard errors

Factor	n	FCA (d)			FCA (mo)		
		$\bar{X} \pm S_{\bar{X}}$	min	max	$\bar{X} \pm S_{\bar{X}}$	min	max
Breed		NS			NS		
RH	82	832.3±4.82	663	1008	27.7±0.16	22.1	33.6
HF	14	818.8±11.14	677	934	27.3±0.37	22.6	33.1
Calving Season		**			**		
Spring	20	913.4±10.04[a]	821	1008	30.4±0.33[a]	27.4	33.6
Summer	54	825.8±7.02[b]	735	901	27.2±0.23[b]	24.5	30.0
Autumn	22	737.4±9.38[c]	663	797	24.6±0.31[c]	22.1	26.6
Overall	96	828.2±7.25	663	1008	27.6±0.24	22.1	33.6

RH: Red Holstein, HF: Holstein Friesian, NS: not significant, **: significant for P<0.01, a,b,c: The difference between groups with the same letter is insignificant for P<0.05.

Table 2. Gestation length (GL) least squares means and standard errors of Red Holstein (RH) and Holstein-Friesian (FH) cows

Factor	GL (d)			
	n	$\bar{X} \pm S_{\bar{X}}$	min	max
Breed		NS		
RH	78	278.2±1.19	252	301
HF	13	279.4±2.91	254	286
Overall	91	278.4±1.09	252	301

NS: not significant

Table 3. Days open (DO) and calving interval (CI) least squares means and standard errors of Red Holstein (RH) and Holstein-Friesian (HF) cows

Factor	DO (d)				CI (d)			
	n	$\bar{X} \pm S_{\bar{X}}$	min	max	n	$\bar{X} \pm S_{\bar{X}}$	min	max
Breed		NS				NS		
RH	79	136.3±10.33	36	373	78	409.1±10.95	319	646
HF	13	127. 6±21.54	36	258	12	409.1±23.46	320	538
Calving Month		NS				NS		
8	4	109.4±35.79	71	172	4	380.5±37.98	326	456
9	14	141.7±19.25	55	258	14	416.4±20.44	321	538
10	37	158.6±12.74	36	373	36	442.0±13.97	320	646
11	31	126.8±15.34	36	201	30	409.5±16.57	319	471
12	6	123.0±29.85	86	186	6	397.0±31.72	333	459
Overall	92	144.0±7.12	36	373	90	421.4±7.66	319	646

NS: not significant

305-Day Milk Yield (305-dMY): Breed and FCA group effects on the 305-dMY of the cattle raised in the farm were found insignificant (P>0.05), and the overall average of 305-dMY was calculated as 6981±137.0 kg. The averages of 305-dMY for RH and HF breeds were calculated as 6785.1±163.54 kg and 7344.6±335.95 kg, respectively (Table 5). Although HF produced 599.5 kg higher milk than RH, this difference was statistically insignificant (P>0.05). The average of 305-dMY in RH ranged between 3883 kg and 9784 kg, and in HF between 6289 and 9270 kg. As FCA increased, 305-dMY increased until the age of 30 months, then decreased in >30 months group. The lowest 305-dMY mean was obtained for the oldest age group (Table 5). While the group with an age >30 months produced 736.3 kg lower milk than the group with the age of 28-30 months, the difference was not found to be statistically significant (P>0.05). The averages of 305-dMY for HF and RH breeds calculated in this study are higher than the averages reported for HF and BS breeds raised in the same region by Koç (2006a). Different from this study, Koç (2006a) found the effect of breed on 305-dMY was statistically significant.

In this study, the averages of 305-dMY obtained for RH and HF cows were compared to the averages reported for HF in some previous studies and the means for both breeds were higher than the means reported in other studies (Uzmay et al., 1998; Duru and Tuncel, 2002b; Kaya et al., 2003; Erdem et al., 2007; Çakıllı and Güneş, 2007; Koç, 2011). The average of 305-dMY calculated for HF cows is higher than the average reported by Koç (2001) for the same breed, but the averages found in this study for both HF and RH cows were lower than 305-dMY mean reported for RH by Yılmaz (2010).

Solid Non-Fat (SNF): SNF determined in milk samples of RH and HF cows was calculated as 9.8±0.04% (Table 4). The lactation month effect on SNF was important (P<0.01), but the effects of breed and breed x lactation month interaction were insignificant (P>0.05). SNF means for RH and HF breeds were calculated as 9.9±0.04% and 9.7±0.09%, respectively.

As seen on Figure 2, SNF average dropped significantly in the fourth lactation month, when DMY average was high, and this low level preserved in the months 4 to 9, after that increased again in 10th and 11th lactation months. There was also a noticeable decrease seen after the 8th month of lactation in DMY.

According to the lactation month, the highest SNF average was obtained for the first lactation month (10.5±0.26%) and the lowest was calculated for the 9th month with 9.1±0.14% (Table 4). While SNF average was over 10% in the first three lactation months (Figure 2), it was below 10% in other months. In terms of lactation months, the 4th, 8th and 9th months differed from the first three lactation months (P<0.05). In addition, 10th month was different from the 1st and 3rd months, also, 9th month differed from the mean of 11th month.

It can be said that SNF averages of RH and HF cows were generally similar (Figure 3). The milk yield decreased in both breeds, especially in the 9th, 10th and 11th lactation month, but the SNF did not rise in 9th month for both breeds and 10th month for HF. Despite, this low level in SNF in milk these months could be attributed to the last period of the lactation coinciding with the summer months.

The air temperature rises in the summer months where the farm is located in the region, and the highest temperature rises above 40^{o}C in many days in June, July and August, and as a result of that creating heat stress for the cows. Under heat stress conditions, while the dry matter intake of the cows decrease, the milk production and at the same time the milk constituents such as fat and protein contents decrease. Thus, it turns out that it is necessary to take some precautions against the heat stress that can be seen in summer in this farm and other farms in the region. As a matter of fact, Koç (2011) reported that SNF was significantly lower in milk samples taken in summer than those taken in the winter period from HF and Montbeliarde breeds.

Table 4. Least square means and standard errors of daily milk yield (DMY, kg), solid non-fat (SNF, %) and somatic cell count ($Log_{10}SCC$) for primiparous Red Holstein (RH) and Holstein-Friesian (HF) cows

Factor	DMY		SNF		Log_{10}SCC	
	n	$\bar{X} \pm S_{\bar{X}}$	N	$\bar{X} \pm S_{\bar{X}}$	n	$\bar{X} \pm S_{\bar{X}}$
Breed		**		NS		NS
RH	751	21.8±0.21^{a}	743	9.9±0.04	737	4.6±0.03
HF	134	24.3±0.49^{b}	133	9.7±0.09	134	4.7±0.06
Lactation month		**		**		**
1	47	24.7±1.39^{ab}	45	10.5±0.26^{ac}	44	4.5±0.17^{abd}
2	74	26.2±0.87^{a}	73	10.2±0.16^{ac}	69	4.2±0.11^{a}
3	91	26.7±0.80^{a}	88	10.3±0.15^{a}	88	4.3±0.10^{a}
4	94	26.7±0.77^{a}	94	9.4±0.14^{bd}	94	4.4±0.10^{ac}
5	94	24.8±0.77^{a}	94	9.7±0.14^{abd}	92	4.5±0.10^{ac}
6	96	24.6±0.77^{a}	96	9.6±0.14^{bcd}	95	4.5±0.09^{ab}
7	96	23.9±0.77^{a}	95	9.9±0.14^{ab}	95	4.9±0.09^{bde}
8	95	23.7±0.77^{a}	94	9.4±0.15^{bd}	95	4.7±0.09^{abde}
9	88	19.5±0.77^{b}	88	9.1±0.14^{d}	88	4.7±0.10^{bcde}
10	75	16.8±0.84^{bc}	75	9.6±0.15^{bcd}	75	5.1±0.10^{de}
11	35	15.7±0.99^{c}	34	10.0±0.18^{ab}	36	5.2±0.12^{e}
Breed × Lac. month		NS		NS		NS
Overall	885	22.7±0.21	876	9.8±0.04	871	4.59±0.024

NS: Not significant, **: Significant for P<0.01, a,b,c,d,e: The difference between the groups with the same letter is insignificant for P<0.05.

Table 5. Least square means and standard errors of 305-dMY for Red Holstein (RH) and Holstein-Friesian (HF) cows

Factor	305-d MY (kg)			
	N	$\bar{X} \pm S_{\bar{X}}$	min	max
Breed		NS		
RH	55	6785.1±163.54	3883	9784
HF	11	7344.6±335.95	6289	9270
FCA group		NS		
1 (<24 mo)	8	6858.3±406.20	4590	9270
2 (24-27 mo)	16	7249.6±297.23	5563	8824
3 (28-30 mo)	30	7444.0±236.46	5121	9784
4 (>30 mo)	12	6707.7±327.95	3883	7866
Overall	66	6981±137.0	3883	9784

NS: Not significant

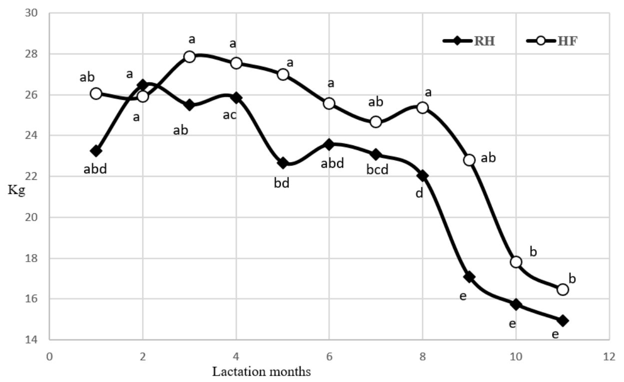

Figure 1. Changes of daily milk yield (DMY) means for RH and HF cows by lactation months.

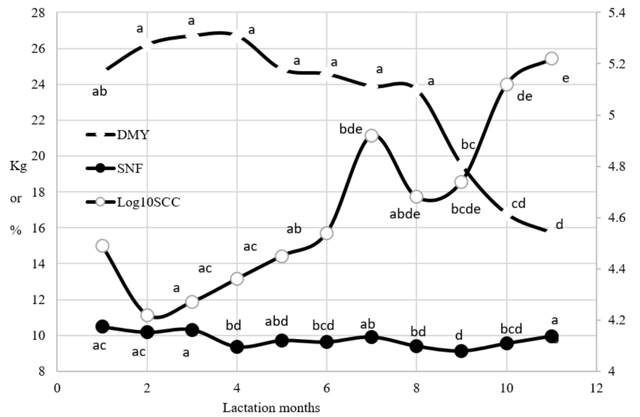

Figure 2. Changes of daily milk yield (DMY), solid non-fat (SNF, %) and somatic cell count ($Log_{10}SCC$) depending on lactation month.

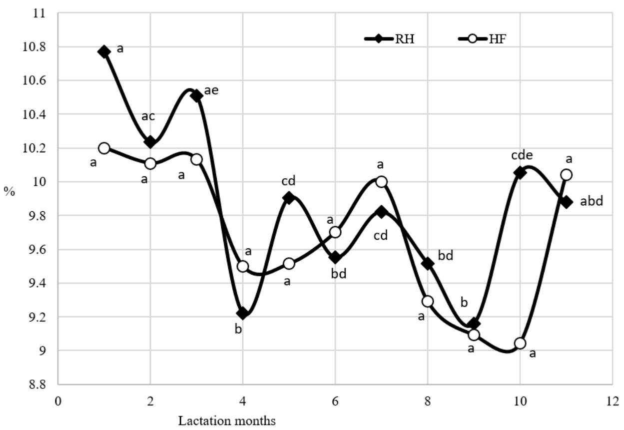

Figure 3. Changes of solid non-fat (SNF, %) for Red Holstein (RH) and Holstein-Friesian (HF) cows depending on lactation month.

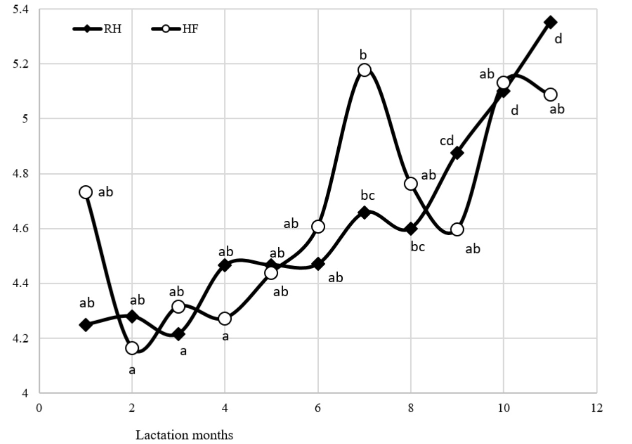

Figure 4. Changes of somatic cell count ($Log_{10}SHS$) for Red Holstein (RH) and Holstein-Friesian (HF) depending on lactation month.

In this study, the averages of SNF obtained for RH and HF cows (9.9±0.08% and 9.7±0.91%, respectively) were lower than the averages reported by Koç (2007b) for HF and Montbeliarde breeds, and for BS breed by Koç (2007b). However, the averages found for both breeds in this study were higher than the values reported for HF (9.6±0.05%) by Koç (2007b), for HF (8.2±0.07%) and Montbeliarde (8.4±0.07%) breeds reported by Koç (2011), and higher than the value reported by Koç (2015) for the first lactating RH cows (8.8±0.04%).

In this study, SNF average found for HF cows was lower than the average reported by Koç (2008a) for HF (9.9±0.02%). The SNF average obtained in this study for RH cows was higher than the average reported by Yılmaz (2010) for the primiparous RH cows (8.9±0.07%).

Somatic Cell Count (SCC): The mean of $Log_{10}SCC$ of cows raised in the farm was 4.59±0.024. The lactation month effect on $Log_{10}SCC$ was statistically significant (P<0.01), but breed and breed x lactation month interaction effects were insignificant (P>0.05). $Log_{10}SCC$ averages for RH and HF cows were calculated as 4.6±0.03 and 4.7±0.06, respectively (Table 4).

The changes of DMY, SNF and Log_{10}SCC according to lactation months are given on Figure 2, and the changes of Log_{10}SCC of RH and HF breeds according to lactation months is given in Figure 4. The Log_{10}SCC average decreased in the second month and increased towards the end of lactation, the increase occurred between the second and seventh lactation months and after a decrease in the eighth month, increased again and reached its highest value in the 11^{th} month (Figure 2). Considering the back-transformed values of Log_{10}SCC, the SCC averages of the last two months of lactation were above 100000 cells / ml, while it was below 50000 cells / ml in lactation months from 1 to 6.

The lowest Log_{10}SCC average occurred in the second lactation month (4.2±0.11), while the differences in the 7^{th} and 9^{th}- 11^{th} lactation months were insignificant (P>0.05), the 11^{th} lactation month differs from the months 2^{nd} - 6^{th} and 8^{th} (P<0.01). It is expected that the SCC value increases towards the end of the lactation and this increase is due to the increase in the density of SCC in the unit volume depending on the decrease in milk yield. Green et al. (2006) examined the milk yield and SCC data both graphically in their study and indicated a dilution effect of milk yield on SCC.

As expected, the mean of Log_{10}SCC of RH and HF increased towards the end of lactation month. Compared to RH, the changes of Log_{10}SCC mean for lactation months was higher in HF (Figure 4). It can be said that the higher changes in Log_{10}SCC in HF breed is due to the higher effect of some individual differences on the average due to the low number of animals in this breed, compared to RH breed.

The overall low SCC means determined for RH and HF cows may be attributed to the cows being in first parities. Due to the low milk yield of the cows in the first lactation and lower rate to being caught by mastitis, the low level of SCC is an expected condition. In previous studies (Koç, 2008b; 2011; Yılmaz, 2010), it was revealed that the SCC level increased due to the increase of parity.

In this study, the averages of SCC for HF and RH cows were lower than all other studies used as literature sources in this study, like HF cows raised in four different farms in Aydın province reported by Koç (2006b), for HF and Montbeliarde cows reported by Koç (2007a and 2011), for HF and BS breeds reported by Koç (2007b), and for HF reported by Koç (2008a, b) and for RH reported by Koç (2015).

In this study, the averages of SCC for RH and HF cows are lower than the average (63753 cells / ml) reported by Yılmaz (2010) for RH cows, but is very close to the average value (47687 cells / ml) reported for the same author for the first lactating RH cows.

Conclusion

Examination of the fertility, milk yield and milk quality characteristics of RH and HF indicated that except for DMY, not any significant differences were determined between these two breeds raised on the same farm. RH cows produced 2.5 kg less milk per day than HF cows. Lactation month effects on DMY, SNF and Log_{10}SCC, and birth season effect on FCA was also determined important. Considering that HF and RH cows were in the first parity, about 7000 kg milk yield level can be considered as an indication that these animals could reach higher milk yield levels in later parities. In order to prevent the decrease in the fertility of cows in the farm, more importance should be given to items such as maintenance, feeding, housing and herd management.

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