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Impact of Milking Frequency on Lactation Performance and Milk Component Yields in Crossbred Friesian Cows in Al-Shatrah City

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Abstract

This study was conducted in Al-Shatrah District, Thi-Qar Province, Iraq, from 1 October 2022 to 31 July 2023, in two private dairy farms to evaluate the effect of milking frequency (once vs. twice daily) on daily and total milk yield, major milk components (fat%, protein%, lactose%), and the yields of fat, protein, and lactose in crossbred Friesian cows (Friesian × AL-Janoubi local breed) raised under the environmental conditions of southern Iraq.A total of 33 lactating cows were used (16 milked once daily and 17 milked twice daily; all hand-milked) at the beginning of lactation, differing in age and parity, and suckling calves of both sexes.Milking frequency significantly affected ($P \leq 0.05$) daily and total milk yield. Cows milked twice daily produced significantly higher ($P \leq 0.05$) daily and total milk yields (8.48 and 2552.02 kg, respectively) compared with cows milked once daily.Milking frequency significantly affected ($P \leq 0.05$) certain milk components. Cows milked once daily showed a significantly higher ($P \leq 0.05$) fat percentage (3.77%) compared with cows milked twice daily. No significant differences were observed in protein% and lactose%, although numerically higher values were recorded for cows milked once daily.Milking frequency also significantly influenced ($P \leq 0.05$) fat, protein, and lactose yields. Cows milked twice daily produced significantly higher amounts of fat, protein, and lactose (7.76, 7.84, and 11.70 kg, respectively).

Keywords: Crossbred Friesian cows; milk yield; fat yield; protein yield; lactose yield.

I. Introduction

Livestock represents a major component of global animal wealth and is primarily raised for milk and meat production.Global milk production has reached approximately 843 billion liters annually and is projected to grow by 22% by 2027 (OECD–FAO, 2024). Cattle contribute about 80% of total global milk production, with the remainder coming from buffaloes, goats, camels, and sheep (FAO, 2019). Milk is defined as a white biological fluid of high nutritional value secreted by the mammary glands of mature female mammals to nourish their offspring (Guetouache et al., 2014). Milk and dairy products are major sources of macro- and micronutrients, including fats, high-quality proteins, calcium, phosphorus, vitamin D, riboflavin, and vitamin B12 (Lin et al., 2021; Cimmino et al., 2023). Approximately 80% of the world's population consumes milk (Fusco et al., 2020).Milk production and composition are influenced by genetic factors, cow age, parity, stage of lactation, production level, environmental conditions (temperature and humidity), seasonal variations, nutrition, milking frequency, and milking intervals (Aleli, 2024).Milking is defined as the removal of milk from the udder either for feeding the offspring or for human consumption without causing harm to the animal or udder tissues (Al-Qudsi & Elia, 2010).Cows are typically milked once, twice, or three times daily. Al-Qudsi and Elia (2010) reported that milking four times daily increased milk yield by 5–10% compared with three times daily; However, it may increase teat damage and labor costs. Lopez-Villalobos et al. (2023) reported that twice-daily milking is practiced in about 55% of New Zealand herds, while once-daily milking accounts for about 10%, and some farmers use mixed systems. McNamara et al. (2008) found that increasing milking frequency from two to three times daily increased milk yield by 14%. Løvendahl and Chagunda

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(2011) reported an increase of 3.5 L/day in milk yield and 92 g/day in fat yield with three milkings per day. Raymond and Pomiès (2005) observed a 25% decrease in milk yield in cows milked once daily. Cooper and Clark (2001) reported higher milk yield and fat, protein, and lactose yields in cows milked twice daily compared with once daily. Raymond et al. (2004) reported that once-daily milking reduced milk yield but increased fat and protein percentages without significant effects on lactose% or somatic cell count. This study aimed to evaluate the effect of milking frequency (once vs. twice daily) on daily and total milk yield, milk composition, and fat, protein, and lactose yields in crossbred Friesian cows under the environmental conditions of Al-Shatrah, southern Iraq.

II. Materials and Methods

The study was conducted in two private dairy farms in Al-Bidaa area, north of Al-Shatrah City, Thi-Qar Province, Iraq, from 1 October 2022 to 31 July 2023.

Animals and Management: Thirty-three lactating crossbred Friesian cows (Friesian × Southern local breed) were used:16 cows milked once daily17 cows milked twice daily.All cows were hand-milked, at early lactation, of varying ages and parities, and suckling calves.Cows were fed seasonally available feeds, including wheat bran, flour, barley grains, and bread residues as concentrates, and alfalfa, reeds, barley green forage (locally known as "Kaseel"), other green forages, and straw as roughage. Concentrates were provided at 1 kg per 2 kg of milk produced. Green forage and dry roughage were offered according to body weight. Feeding regimes were similar in both farms. Water was available ad libitum, and cows were managed under veterinary supervision.

Milk Measurement and Analysis: Daily milk yield (kg) was measured using a weighing scale. Milk samples (100 mL) were collected twice monthly and stored in an ice box until laboratory analysis. Milk components were analyzed using a Lacto Flash (Funke Gerber, Germany). Fat, protein, and lactose yields were calculated according to Al-Qudsi and Elia (2010).

Statistical analysis: Data were analyzed using SPSS (2006). Mean differences were tested using the Least Significant Difference (LSD) test at $P \leq 0.05$.

Results and Discussion

Effect on Daily and Total Milk Yield: Milking frequency significantly affected ($P \leq 0.05$) daily and total milk yield.Cows milked twice daily produced significantly higher yields (8.48 ± 0.39 kg/day; 2552.02 ± 11.70 kg total) compared with cows milked once daily (2.90 ± 0.14 kg/day; 856.56 ± 3.70 kg total).This may be attributed to reduced intramammary pressure and increased milk secretion rate with more frequent milking (Al-Qudsi & Elia, 2010). These results agree with Dalley et al. (2008), O'Brien et al. (2009), Lembeye et al. (2016), Jayawardana et al. (2022), Lopez-Villalobos et al. (2023), and Aleli (2024).

Table 1. Effect of Milking Frequency on Daily and Total Milk Yield (Mean ± SE)

Milking Frequency	Daily Milk Yield (kg)	Total Milk Yield (kg)
Once daily	2.90 ± 0.14 b	856.56 ± 3.70 b
Twice daily	8.48 ± 0.39 a	2552.02 ± 11.70 a

Different letters within the same column indicate significant differences at $P \leq 0.05$.

Effect on Milk Components: Milking frequency significantly affected fat percentage. Cows milked once dailyhad higher fat% (3.77 ± 0.17) compared with cows milked twice daily (3.18 ± 0.15). No significant differences were observed in protein% and lactose%.This may be explained by the inverse relationship between milk yield and milk component concentration (Al-Qudsi & Elia, 2010; Al-Fayad, 2025). Results agree with Raymond et al. (2004) and Lopez-Villalobos et al. (2023).

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Table 2. Effect of Milking Frequency on Milk Composition (%) (Mean ± SE)

Milking Frequency	Fat (%)	Protein (%)	Lactose (%)
Once daily	3.77 ± 0.17 a	3.24 ± 0.11 a	4.81 ± 0.11 a
Twice daily	3.18 ± 0.15 b	3.07 ± 0.12 a	4.51 ± 0.14 a

Different letters within the same column indicate significant differences at $P \leq 0.05$.

Effect on Fat, Protein, and Lactose Yields: Cows milked twice daily produced significantly higher fat (7.76 ± 0.60 kg), protein (7.84 ± 0.51 kg), and lactose yields (11.70 ± 0.64 kg) compared with cows milked once daily (3.24 ± 0.21; 2.77 ± 0.14; 3.99 ± 0.20 kg).These findings agree with Dalley et al. (2008), Clark et al. (2006), O'Brien et al. (2009), Lembeye et al. (2016), and Jayawardana et al. (2022).

Table 3. Effect of Milking Frequency on Fat, Protein, and Lactose Yield (kg) (Mean ± SE)

Milking Frequency	Fat Yield (kg)	Protein Yield (kg)	Lactose Yield (kg)
Once daily	3.24 ± 0.21 b	2.77 ± 0.14 b	3.99 ± 0.20 b
Twice daily	7.76 ± 0.60 a	7.84 ± 0.51 a	11.70 ± 0.64 a

Different letters within the same column indicate significant differences at $P \leq 0.05$

III. Conclusions

Increasing milking frequency from once to twice daily significantly increased daily and total milk yield. Fat percentage was higher in cows milked once daily. However, fat, protein, and lactose yields were significantly higher in cows milked twice daily.An inverse relationship was observed between milk yield and fat percentage, while a positive relationship was found between milk yield and fat, protein, and lactose yields.

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