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Seasonal Variation Effects on Milk Yield and Major Milk Components in Friesian Cows Raised in Southern Iraq

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Abstract

This study evaluated the impact of seasonal variation (autumn, winter, spring, and summer) on daily and total milk yield, milk composition (fat, protein, and lactose percentages) and milk component yields in Friesian cows raised in Shatrah City, Thi-Qar Province, Iraq. Thirty lactating cows were monitored from October 2024 to July 2025 under field conditions. Data were analyzed using SPSS (2006), and means were compared using the Least Significant Difference (LSD) test at $P \leq 0.05$. Season significantly affected daily and total milk yield ($P \leq 0.05$). The highest production was recorded in spring (8.25 ± 1.04 kg/day; 246.27 ± 31.46 kg total), while the lowest was observed in summer (5.77 ± 0.65 kg/day; 170.84 ± 19.14 kg total). Milk fat and protein percentages were not significantly affected by season ($P > 0.05$), whereas lactose percentage was significantly higher in summer. Milk component yields (fat, protein, and lactose) were significantly greater in spring compared with autumn and summer. These findings confirm that seasonal variation plays a critical role in dairy productivity under southern Iraqi climatic conditions, mainly due to heat stress and feed availability dynamics.

Keywords: Seasonality, Friesian cows, milk yield, milk composition, heat stress, dairy performance.

I. Introduction

Dairy production in Iraq constitutes an essential component of national food security and rural economic sustainability. However, milk yield and composition are highly influenced by environmental stressors, particularly seasonal fluctuations in temperature and humidity. Heat stress is a major limiting factor affecting dairy performance in subtropical regions. Elevated ambient temperatures reduce feed intake, alter endocrine regulation—particularly thyroid hormone activity—and impair metabolic efficiency, leading to decreased milk synthesis. Conversely, moderate climatic conditions and improved forage availability during spring are typically associated with enhanced dairy productivity. Although Friesian cattle are widely reared in Iraq for milk production, limited studies have quantified seasonal effects under southern Iraqi environmental conditions. Therefore, this study aimed to evaluate the influence of seasonal variation on milk yield, milk composition, and milk component yields in Friesian cows raised in Shatrah City.

II. Materials and Methods

Study Location and Animals

The study was conducted in a private dairy farm in Shatrah District, Thi-Qar Province, Iraq, from 1 October 2024 to 31 July 2025.Thirty Friesian lactating cows at early lactation were included. Animals differed in age and parity and were managed under semi-intensive conditions.

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Feeding and Management

Cows were fed seasonally available diets consisting of wheat bran, barley, flour residues, bread waste, alfalfa, green forage, and straw. Water was available ad libitum. Animals were maintained under routine veterinary supervision.

Milk Measurement and Sampling

Daily milk yield (kg) was recorded using a calibrated scale. Milk samples (100 mL) were collected twice monthly for compositional analysis and preserved under chilled conditions until laboratory examination.Milk fat, protein, and lactose percentages were determined using a Lacto Flash (Funke Gerber, Germany). The amount of fat, protein, and lactose were estimated according to (Al-Qudsi and Elya, 2010).

Statistical Analysis

Data were analyzed using SPSS (2006). The statistical model used was:

$Yij = \mu + Si + eij$

Where:

Yij = observed trait

μ = overall mean

Si = fixed effect of season

eij = random error

Means were compared using LSD at $P \leq 0.05$.

III. Results and Discussion

Effect of Season on Daily and Total Milk Yield

Table (1) shows a significant effect ($P \leq 0.05$) of season on daily and total milk yield. Spring season significantly ($P \leq 0.05$) exceeded autumn and summer in both daily and total milk production. Winter also significantly ($P \leq 0.05$) exceeded summer in daily and total milk yield. However, no significant differences ($P > 0.05$) were observed between winter and spring, winter and autumn, or autumn and summer.

The means for daily milk yield were 6.71 ± 0.67, 7.95 ± 0.99, 8.25 ± 1.04, and 5.77 ± 0.65 kg for autumn, winter, spring, and summer, respectively. The corresponding total milk yields were 201.50 ± 29.96, 239.04 ± 30.09, 246.27 ± 31.46, and 170.84 ± 19.14 kg.

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

Season	Daily Milk Yield (kg)	Total Milk Yield (kg)
Autumn	6.71 ± 0.67 bc	201.50 ± 29.96 bc
Winter	7.95 ± 0.99 ab	239.04 ± 30.09 ab
Spring	8.25 ± 1.04 a	246.27 ± 31.46 a
Summer	5.77 ± 0.65 c	170.84 ± 19.14 c

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Different superscripts within columns indicate significant differences at P ≤ 0.05.

These results are consistent with Marai and Habeeb (2010), Nantapo and Muchenje (2013), Al-Fayad (2015), Zaman et al. (2016), and Habibi et al. (2021). The reason for this may be attributed to moderate temperatures and availability of green forage during spring (Habibi et al., 2021). The results obtained during winter and summer are in agreement with Renna et al. (2010), Al-Kilabi (2013), and Al-Fayad (2023a).

Mitsunori and Shigeru (2003) reported that high temperatures negatively affect milk production and its components. This may be due to the reduction in feed intake during summer caused by decreased thyroxine hormone levels under high temperature conditions, which consequently leads to reduced milk productivity (Hurley, 2003).

Effect of Season on Milk Composition

Table (2) indicates a significant effect (P ≤ 0.05) of season on lactose percentage. Summer season significantly (P ≤ 0.05) exceeded autumn and winter, but did not differ significantly from spring.No significant differences (P > 0.05) were observed among seasons in fat and protein percentages. However, a numerical (non-significant) increase was observed in summer compared with other seasons.

The mean values were as follows:Fat percentage:3.03 ± 0.29 (autumn), 3.20 ± 0.30 (winter), 3.45 ± 0.26 (spring), 3.82 ± 0.41 (summer).Protein percentage: 3.02 ± 0.16 (autumn), 3.12 ± 0.20 (winter), 3.12 ± 0.14 (spring), 3.36 ± 0.19 (summer)Lactose percentage:4.43 ± 0.21 (autumn), 4.33 ± 0.27 (winter), 4.62 ± 0.21 (spring), 4.96 ± 0.26 (summer).

Table 2. Effect of Season on Milk Composition (Mean ± SE)

Season	Fat (%)	Protein (%)	Lactose (%)
Autumn	3.03 ± 0.29 a	3.02 ± 0.16 a	4.43 ± 0.21 b
Winter	3.20 ± 0.30 a	3.12 ± 0.20 a	4.33 ± 0.27 b
Spring	3.45 ± 0.26 a	3.12 ± 0.14 a	4.62 ± 0.21 ab
Summer	3.82 ± 0.41 a	3.36 ± 0.19 a	4.96 ± 0.26 a

Different superscripts within columns indicate significant differences at P ≤ 0.05.

The reason for this may be attributed to the inverse relationship between milk yield and milk components (Al-Qudsi & Elia, 2010), or possibly due to a decrease in milk water content and certain other components (Al-Kilabi, 2013).These findings agree with Marai et al. (2007), Mariassegaram et al. (2007), Al-Kilabi (2013), and Al-Fayad (2015). They partially agree with Kadzere et al. (2002), Wheelock et al. (2010), and Al-Fayad (2025), but disagreed with Waldner et al. (2004), Robinson (2004), Al-Fayad (2023a), and Hussein and Ali (2024).

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Effect of Season on Milk Component Yields

Table (3) shows a significant effect ($P \leq 0.05$) of season on fat, protein, and lactose yields. Spring season significantly ($P \leq 0.05$) exceeded autumn and summer in fat, protein, and lactose yields.No significant differences ($P > 0.05$) were observed between spring and winter, nor among winter, autumn, and summer for fat, protein, and lactose yields.The mean values (kg) were as follows:Fat yield: 6.20 ± 0.038 (autumn), 7.70 ± 0.83 (winter), 8.48 ± 0.16 (spring), 6.19 ± 0.57 (summer) Protein yield:6.07 ± 0.05 (autumn), 7.49 ± 0.41 (winter), 7.67 ± 0.17 (spring), 5.74 ± 0.27 (summer)Lactose yield:8.92 ± 0.24 (autumn), 10.34 ± 0.25 (winter), 11.35 ± 0.25 (spring), 8.47 ± 0.49 (summer).

Table 3. Effect of Season on Milk Component Yields (kg) (Mean ± SE)

Season	Fat Yield (kg)	Protein Yield (kg)	Lactose Yield (kg)
Autumn	6.20 ± 0.038 b	6.07 ± 0.05 b	8.92 ± 0.24 b
Winter	7.70 ± 0.83 ab	7.49 ± 0.41 ab	10.34 ± 0.25 ab
Spring	8.48 ± 0.16 a	7.67 ± 0.17 a	11.35 ± 0.25 a
Summer	6.19 ± 0.57 b	5.74 ± 0.27 b	8.47 ± 0.49 b

Different superscripts within columns indicate significant differences at $P \leq 0.05$.

These results agree with Hassooni and Abboud (2014), Shevhuzhev et al. (2017), Al-Fayad (2023b), and Al-Fayad (2025), who indicated that milk component yields increase with increased milk production.

IV. Conclusion

Season significantly influences milk yield and milk component production in Friesian cows under southern Iraqi conditions.Spring represents the most favorable production season, while summer heat stress significantly reduces dairy performance.Implementation of cooling systems, ration reformulation, and thermal stress monitoring is recommended to enhance production efficiency.

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