



Impact of Somatic Cell Count on Milk Yield and Composition in Simmental Cows Under Semi-Arid Conditions of Erbil .

Shireen Ihsan Izzadeen¹

Ali KAYGISIZ²

¹Department of Animals Resource, Agricultural Engineering College, Salahaddin University-Erbil, IRAQ.

²Animal Resource Department , Agriculture College, Kahramanmaraş Sütçü İmam University, Kahramanmaraş, TÜRKİYE.

*Corresponding Author: shireen.izzadeen@su.edu.krd

Received: 21/06/2025

Revised:30/07/2025

Accepted: 17/08/2025

Published: 01/09/2025

ABSTRACT

The aim of this study was to evaluate the effects somatic cell count on milk yield and composition in Simmental dairy cows. The cows were milked by machine twice a day during the period. Milk samples were taken at monthly intervals from each cow during the evening milking between September 2024 and April 2025. Monthly variation significantly affected milk yield and composition ($P < 0.001$), whereas somatic cell count did not show a statistically significant effect ($P = 0.1315$). The ratio of fat, protein, solid not fat, lactose, density, salt, freezing point, water, milk temperature and milk electrical conductivity no statistical difference was observed in the level of somatic cell counts ($P > 0.05$). The somatic cell count increased ($P < 0.001$) in milk with high levels of somatic cell count. Milk fat percentage was significantly higher in cows with ketosis ($P < 0.001$), whereas protein levels increased significantly in cows with acidosis ($P = 0.003$). This study indicates that high somatic cell counts negatively affect not only milk composition but also milk yield and quality.

Keywords: somatic cell count, milk yield, milk composition, acidosis, ketosis.

Copyright © 2025. This is an open-access article distributed under the Creative Commons Attribution License.

Introduction

Monthly difference in milk composition and milk yield is a critical indicator in dairy science, providing insights for optimizing animal performance, feed resource planning, and overall milk quality. Simmental cattle, known for their dual-purpose capabilities, exhibit notable fluctuations in these traits across the lactation cycle and under varying environmental conditions [1]. Understanding such temporal dynamics is essential for developing feeding strategies that align with both seasonal nutrient availability and physiological demands. Recent research by [2] reported that feed variability, shaped by management systems and seasonal shifts, significantly influences milk yield and environmental performance in high-yielding Simmental herds raised in mountainous regions. Moreover, milk composition parameters particularly fat, protein, and somatic cell count serve as important biomarkers for metabolic health and udder condition [3, 4]. Monthly monitoring of these indicators enables early disease detection and supports long-term genetic selection. Studies have also linked somatic cell count with milk yield and quality, underscoring the role of nutritional management in regulating these parameters [5, 6, 7, 8, 9,10,11,12 and 13]. In recent years, a growing body of research has investigated the dynamics of milk yield and composition in Simmental cattle, highlighting the combined influence of genetic potential and environmental management. [14], focusing on Simgoud crossbreeds Simmental Goudali observed that concentrate supplementation led to marked improvements in milk yield as well as in fat and protein content. Its composition is influenced by a variety of factors, including age, breed, stage of lactation, nutrition, milking interval, and seasonal variation [15]. Among the key indicators of milk quality and udder health, somatic cell count (SCC) is widely used in dairy science as a diagnostic and management tool. Somatic cells primarily consist of leukocytes white blood cells produced as part of the immune response to mammary gland infections such as mastitis, a prevalent intramammary condition. A smaller proportion of somatic cells include epithelial cells sloughed from the mammary epithelium during the lactation process. Elevated SCC levels are commonly associated with impaired milk quality, reduced yield, and increased risk of clinical or subclinical mastitis. Raised somatic cell count (SCC) levels are strongly associated with intramammary infections, particularly subclinical mastitis [16]. Although affected cows may not display visible clinical symptoms, a high SCC indicates an ongoing inflammatory response within the udder tissue. Many dairy payment systems worldwide incorporate SCC thresholds into their pricing structures, imposing financial penalties for high SCC values and offering bonuses for herds maintaining low counts. As such, maintaining low SCC levels is not only essential for animal health and milk quality but also for ensuring economic sustainability in dairy operations. Elevated SCC levels have been associated with reduced milk yield [3, 5, 6, 7, 8, 9, 10, and 17] and with a decline in the quality of dairy products [11, 12, and 13]. Taking cow milk as an example, when $SCC > 2 \times 10^3$

cells.mL⁻¹, the udder is considered to be infected, and when SCC > 4 × 10³ cells.mL⁻¹, the milk is deemed unfit for human consumption in the European Union (EU) [18]. In summary, SCC is a non-invasive, cost-effective, and widely adopted tool to evaluate udder health, milk hygiene, and overall dairy herd performance. Reducing SCC through proper management, hygiene practices, and selective breeding contributes to improved animal welfare, milk quality, and economic efficiency. Somatic cell count (SCC) in milk is widely recognized as a critical indicator of both udder health [19] and an animal's resistance or susceptibility to mastitis [4]. Mastitis remains one of the most prevalent and economically damaging health issues in high-producing dairy breeds [20]. It is defined as the inflammation of the parenchyma of the mammary gland, characterized by physical, chemical, and typically bacteriological changes in milk, alongside pathological alterations in glandular tissues [21]. Somatic cells in milk are composed primarily of milk-secreting epithelial cells shed from the mammary lining and white blood cells (leukocytes) that infiltrate the gland in response to infection or tissue injury [22]. An increase in somatic cell count (SCC) is known to negatively affect milk composition, yield, and quality [23, 24]. The impact of somatic cell count on milk composition has been the subject of many studies. [25] reported both negative and positive correlations between log-transformed SCC and lactose and protein levels. Similarly, [26] found that elevated SCC was associated with increased protein content. Conversely, [27] observed no significant change in milk fat content in relation to SCC levels. Seasonal variation in somatic cell count has also been documented. [28] noted significantly higher somatic cell count levels during autumn and winter, which may be attributed to housing conditions, environmental stressors, and changes in animal immunity during cold months. The protein and fat content of milk are essential indicators of metabolic health and nutritional balance in dairy herds. These parameters not only reflect management efficiency but also help detect conditions such as acidosis or ketosis, and provide insight into dietary energy and protein utilization [29]. Therefore, the aim of this study was to investigate the effects of somatic cell count on milk composition, yield and metabolic disease in Simmental dairy cows.

Materials and methods

A total of 34 Simmental cows were used in the study: 13 in their first lactation and 21 in their second and third lactations combined. The cows were milked by machine twice a day during the period. Milk samples were taken at monthly intervals from each cow during the evening milking between September 2024 and April 2025. Milk samples were transferred to 50 ml plastic sterile tubes on icebox at 4°C until analyzed. Milk composition parameters (fat, protein, solids-not-fat (SNF), lactose, density, salt, freezing point, milk water, milk temperature and milk electrical conductivity) were analyzed by (Master Classic LM2, Bulgaria), and the SCC (cells/mL) was analyzed using Lactoscan, Bulgaria).

Mathematical model used in statistical analysis

In Model-1, the effects of sampling month on milk yield or composition were analyzed.

In Model-2, the effects of somatic cell count classes on milk yield or composition were analyzed.

In Model-3, the effects of metabolic diseases on milk yield and composition were examined.

$$Y_{ij} = \mu + a_i + e_{ij} \text{ (model-1)}$$

$$Y_{ij} = \mu + b_i + e_{ij} \text{ (model-2)}$$

$$Y_{ij} = \mu + c_i + e_{ij} \text{ (model-3)}$$

and the terms in this model are; Y_{ij} represents any yield trait, μ = population mean, a_i = i. sampling month effect size, b_i = i. somatic cell count class effect size, c_i = i. metabolic diseases class effect size, e_{ij} = normal, independent and chance error. Duncan's multiple range tests was used to compare the means of different subgroups. Statistical analyses were carried out by using SAS packet program [30].

Results and Discussion

Table 1 presents the effect of different lactation months on milk composition, milk yield, and somatic cell count in Simmental dairy cows. Most milk composition parameters including density, lactose, protein, fat, electrical conductivity, milk temperature, and salt content showed significant variation across months ($P < 0.001$), except for SNF (Solid-Non-Fat) ($P = 0.3555$) and water percentage ($P = 0.3897$), which were not significantly affected. The highest fat content was observed in January (Month 5) at 7.807%, significantly higher than other months ($P < 0.001$), indicating a seasonal rise potentially due to changes in forage availability or environmental conditions. Milk yield varied significantly across months ($P < 0.001$), with peak yields in February (26.375 kg) and April (25.777 kg). These months align with early to mid-lactation and likely favorable feeding and temperature conditions. No statistically significant differences were found in SCC or Log₁₀ SCC across months ($P = 0.1315$, $P = 0.1229$), indicating that seasonality alone may not significantly effect SCC levels in this herd. A statistically significant increase in milk fat percentage was observed during the March month of lactation ($7.807 \pm 0.4045\%$; $P < 0.001$) compared to other months. Similarly, the highest values for protein, lactose, and milk density were recorded in the November month ($3.466 \pm 0.0410\%$, $5.252 \pm 0.0611\%$, and $33.672 \pm 0.5878\%$, respectively), all statistically significant ($P < 0.001$). The highest solid-not-fat (SNF) content was detected in the December month ($12.152 \pm 1.0585\%$), while the lowest was in the April month ($8.778 \pm 0.9594\%$). However, the difference in SNF was not significant ($P = 0.3555$). Salt content and freezing point showed significant differences across months, with the highest salt percentage in the November month ($0.740 \pm 0.0103\%$; $P = 0.0025$) and the lowest freezing point in the April month (-

0.582 ± 0.0076°C; P = 0.0355). Milk temperature and electrical conductivity were also significantly affected in the September and April months (P < 0.001). These findings are consistent with previous studies [15, 31 and 32]. [33] observed that increases in milk yield are often accompanied by a reduction in milk component percentages. This inverse relationship may be explained by the negative correlation between dry matter content and milk volume, as well as energy balance deficits during the early postpartum period. Regarding somatic cell counts, the December month showed relatively high SCC and Log₁₀SCC values (1138.407 ± 243.2168 × 10³ cells/mL and 2.624 ± 0.1602, respectively); however, these differences were not significant (P = 0.1229 and P = 0.1315). Some studies report higher somatic cell count values during winter months [34, 35], while others, such as [31], observed lower SCC levels during early and mid-lactation stages. The observed elevation in SCC during late lactation may be attributed to a higher incidence of mastitis, normal physiological remodeling of the udder, and reduced milk output, which limits dilution of leukocytes in the milk [36].

As presented in Table 2, the effect of somatic cell count on milk yield and composition was found to be statistically insignificant (P > 0.05). Despite noticeable differences across SCC classes, none of the milk composition traits showed statistically significant variation with SCC levels (all P > 0.05). For instance: Fat %: Ranged from 5.216% to 5.830% (P = 0.8651). Protein %: Very stable across groups, around 3.29–3.35% (P = 0.6128). Lactose, SNF, Salt, and Conductivity: Also non-significant differences. However, the SCC values themselves varied significantly between groups (P < 0.001), validating that the classification was appropriate: SCC increased sharply from 47.55 × 10³ cells/mL in the lowest class to 1154.60 × 10³ cells/mL in the highest class. Corresponding Log₁₀ SCC values ranged from 1.566 to 2.867. Although higher SCC is often associated with mastitis and milk quality deterioration, no significant changes were observed in milk yield or composition in this study, suggesting subclinical mastitis may not immediately influence all milk parameters. The overall mean SCC was calculated as 447.567 ± 78.294 × 10³ cells/mL (Log₁₀ SCC: 2.252). This value is higher than those reported by [24, 8], who documented SCC values of 437.9 × 10³ and 291.072 × 10³ cells/mL, respectively (P < 0.001). However, it remains lower than the SCC values reported by [37] at 1.510 × 10³ cells/mL and by [38], who noted a Log₁₀ SCC of 5.73. Somatic cell levels in milk are influenced by numerous factors, among which herd management practices play a critical role. Given the strong association between management and SCC [39], particular attention should be paid to milking hygiene and the application of precise milking procedures to maintain optimal udder health and milk quality.

Data presented in Table 3 illustrate the impact of metabolic diseases on milk composition, milk yield, and somatic cell counts (SCC) in dairy cows. In a state of ketosis, caused significant increases in fat (7.275%) and electrical conductivity (5.1016 mS/cm) (P < 0.001), indicating elevated milk fat mobilization and udder permeability. Associated with reduced lactose (4.898%) and protein content (3.250%), likely due to negative energy balance. In a state of ketosis; Significantly increased lactose (5.122%), milk protein (3.392%), density, and salt content, and showed the highest milk temperature (14.515°C) (P values < 0.001–0.0016). Showed lowest fat content (2.085%), consistent with rumen dysfunction affecting fat synthesis. In a normal Cows, had moderate values across most parameters and lower SCC (not significant, P = 0.0985). SCC was highest in normal cows (716.1 × 10³ cells/mL), followed by ketosis and acidosis groups. Although differences were non-significant (P = 0.0985 for SCC and P = 0.0707 for Log₁₀ SCC), the data hint at unexpected elevations even in cows without visible disease, which may suggest subclinical infections or sampling variation. Notably, cows affected by ketosis exhibited significantly higher levels of milk fat (7.275 ± 0.137%) and milk electrical conductivity (5.1016 ± 0.040 mS/cm), with statistical significance at P < 0.001 and P = 0.0005, respectively.

Table 1. Variation of milk composition according to factors in Simmental cows

	n.	Fat (%)	Protein (%)	SNF (%)	Lactose (%)	Density (mg/ml)
Overall	20	5.568±0.1871	3.297±0.0153	9.453±0.3579	4.974±0.0231	29.516±0.2597
P value	2	P<0.001	P<0.001	P=0.3555	P<0.001	P<0.001
Month						
Septem ber	21	5.728±0.4500b	3.252±0.0447d	8.971±1.1078	4.904±0.0667c	28.861±0.6414b
October	26	2.642±0.4045c	3.380±0.0402a b	9.338±0.9956	5.096±0.0599ab	32.969±0.5764a
Novem ber	25	3.004±0.4125c	3.466±0.0410a a	9.600±1.0153	5.252 ±0.0611aa	33.672±0.5878aa
Decemb er	23	5.617±0.4300b	3.282±0.0427c	12.152±1.0585	4.930 ±0.0637c	29.169±0.6129b
January	26	7.807±0.4045aa	3.250±0.0402d	8.980±0.9956	4.919 ±0.0599c	27.150±0.5764c
Februar y	24	6.875±0.4210ab	3.325±0.0418c	9.170±1.0362	5.012 ±0.0624b	28.666±0.6000b
March	29	6.431±0.3830b	3.251±0.0380d	8.951±0.9427	4.903 ±0.0567c	28.237±0.5458b

April	28	6.321±0.3897b	3.185±0.0387d	8.778±0.9594	4.792 ±0.0577c	27.628±0.5555b
	n.	Salt (%)	Freezing point(°C)	Water (%)	Milk temperature(°C)	Conductivity (mS/cm)
Overall	202	0.702±0.0037	-0.599±0.0029	0.034±0.0346	13.284±0.136	5.001±0.0321
P value		P=0.0025	P=0.0355	P=0.3897	P<0.001	P<0.001
Month						
September	21	0.695±0.0112b	-0.591±0.0088 ab	0.000±0.1073	16.542±0.2717a	5.061±0.0924ab
October	26	0.715±0.0101ab	- 0.596±0.0079ab	0.00±0.0964	14.653±0.2442b	4.723±0.0830c
November	25	0.740±0.0103aa	-0.615±0.0081b	0.00±0.0983	14.052±0.2491b	4.860±0.0847c
December	23	0.695±0.0107b	-0.594±0.0084 ab	0.00±0.1025-	12.456±0.2597d	4.952±0.0883c
January	26	0.684±0.0101b	-0.607±0.0079b	0.000±0.0964	12.007±0.2442d	4.800±0.0830c
February	24	0.712±0.0105ab	-0.615±0.0082b	0.291±0.1004	12.270±0.2542d	5.091±0.0864ab
March	29	0.696±0.0095b	-0.595±0.0075 ab	0.000±0.0913	11.551±0.2312e	5.224±0.0786aa
April	28	0.685±0.0097b	- 0.582±0.0076aa	0.000±0.0929	13.410±0.2353c	aa5.264±0.0800

	n.	SCC (×10 ³) (cells/mL)	Log ₁₀ SCC	n.	Milk yield (kg)
Overall	130	447.567±78.294	2.252±0.0515	201	21.995±0.4523
P value		P=0.1229	P=0.1315		P<0.001
Month					
September	20	315.495±196.0876b	2.244±0.1292ab	21	19.714±1.278c
October	20	212.150±196.0876b	1.995±0.1292b	26	20.153±1.1491c
November	16	358.162±219.2326b	2.217±0.1444ab	25	18.680±1.1719c
December	13	1138.407±243.2168aa	2.624±0.1602aa	23	19.434±1.2218c
January	16	373.350±219.2326b	2.120±0.1444b	26	21.038±1.1491c
February	16	279.162±219.2326b	2.271±0.1444ab	24	26.375±1.1960aa
March	16	646.031±219.2326ab	2.292±0.1444ab	29	23.896±1.0881ab
April	13	486.4846±243.2168b	2.421±0.1602ab	27	25.777±1.1276aa

a, b, c; d; The differences between means represented by different letters in the same column are significant (P<0.05).

Table 2. Variation of milk content according to somatic cell counts in Simmental cows

CC Class	Overall	<100×10 ³	100-200×10 ³	200-300×10 ³	>300×10 ³	P value
Item	N=166	N=37	N=30	N=23	N=40	
Fat (%)	5.52±0.206	5.216±0.445	5.466±0.494	5.830±0.564	5.487±0.428	P=0.8651
Protein (%)	3.315±0.016	3.343±0.034	3.351±0.038	3.308±0.044	3.292±0.033	P=0.6128
SNF (%)	9.574±0.434	9.221±1.036	11.643±1.150	9.095±1.314	9.090±0.996	P=0.3064
Lactose (%)	4.997±0.025	5.043±0.053	5.063±0.059	4.973±0.068	4.957±0.051	P=0.4792
Density (mg/ml)	29.722±0.285	±0.60230.305	30.116±0.668	29.308±0.763	29.557±0.579	P=0.6857
Salt (%)	0.706±0.004	0.713±0.008a	±0.0097160.	0.700±0.010	±0.0080.690	P=0.3343
Freezing pointe (°C)	-0.602±0.003	-0.607±0.006	-0.610±0.007	-0.602±0.008	-0.598±0.006	P=0.6686
Water (%)	0.042±0.042	0.000±0.101	0.000±0.112	-0.000±0.128	±0.0970.175	P=0.5269
Milk temperature (°C)	13.415±0.153	13.89±0.337	13.226±0.375	13.37±0.428	13.59±0.324	P=0.5269
Conductivity (mS/cm)	4.997±0.035	±0.0774.972	5.030±0.085	4.865±0.098	5.000±0.074	P=0.6219
Milk yield	N=165 22.15±0.499	N=37 ±0.946621.51	N=30 22.40±1.0513	N=23 22.95±1.2007	N=39 22.461±0.922	P=0.7955

(kg)	N=130	N=37	0 N=30	N=23	N=40	
SCC ($\times 10^3$) (cells/mL)	447.56 $\pm$ 78.29	47.55 $\pm$ 125.424 b	152.30 $\pm$ 139.2 9b	246.57 $\pm$ 159.08 b	1154.60 $\pm$ 120.6 2a	P<0.001
Log ₁₀ SCC	2.252 $\pm$ 0.0515	1.566 $\pm$ 0.049d	$\pm$ 0.05c2.17	2.38 $\pm$ 0.06b	2.867 $\pm$ 0.047a	P<0.001

a, b, c; d; The differences between means represented by different letters in the same column are significant (P<0.05).

However, other milk components were generally lower in cows with ketosis. Interestingly, milk yield was higher in cows diagnosed with ketosis. Conversely, acidosis was associated with significant increases in milk protein (P = 0.0003), lactose (P = 0.0001), density (P < 0.001), salt content (P = 0.0016), and milk temperature (P < 0.001). Somatic cell counts were slightly elevated in healthy cows compared to those with ketosis or acidosis, though this difference was not statistically significant (P = 0.0985). Ketosis is recognized as a critical metabolic disorder in dairy cows, particularly during the transition period [40]. [41] reported that milk fat content was significantly lower in cows experiencing acidosis (P < 0.05), while protein content was reduced in Brown Swiss cows suffering from ketosis (P < 0.05). Subclinical ketosis, in particular, is acknowledged as a major production disease that contributes to substantial economic losses in the dairy industry [42]. It typically occurs in high-producing cows, where energy balance challenges are most pronounced [40].

Table 3. Variation of milk content according to metabolic diseases in Simmental cows

Metabolic Diseases	Acidosis	Ketosis	Normal	P value
Item	N=40	N=122	N=40	
Fat (%)	2.085 $\pm$ 0.240c	7.275 $\pm$ 0.137a	3.845 $\pm$ 0.240b	P<0.001
Protein (%)	3.392 $\pm$ 0.033aa	3.250 $\pm$ 0.019b	3.348 $\pm$ 0.033a	P=0.0003
SNF (%)	9.382 $\pm$ 0.797ab	8.952 $\pm$ 0.456b	11.055 $\pm$ 0.797aa	P=0.0753
Lactose (%)	5.122 $\pm$ 0.050aa	4.898 $\pm$ 0.028b	5.057 $\pm$ 0.050a	P=0.0001
Density (mg/ml)	33.622 $\pm$ 0.417a	27.485 $\pm$ 0.239c	31.607 $\pm$ 0.417b	P<0.001
Salt (%)	0.725 $\pm$ 0.008aa	0.692 $\pm$ 0.004b	0.712 $\pm$ 0.008ab	P=0.0016
Freezing pointe (°C)	-0.595 $\pm$ 0.006	-0.601 $\pm$ 0.003	-0.597 $\pm$ 0.006	P=0.6761
Water (%)	0.000 $\pm$ 0.077	0.000 $\pm$ 0.044	0.175 $\pm$ 0.077	P=0.1320
Milk temperature (°C)	14.515 $\pm$ 0.291a	12.853 $\pm$ 0.166b	13.367 $\pm$ 0.291b	P<0.001
Conductivity (mS/cm)	4.825 $\pm$ 0.069b	5.1016 $\pm$ 0.040a	4.875 $\pm$ 0.069b	P=0.0005
Milk yield (kg)	N=40 20.825 $\pm$ 1.0039	N=121 22.884 $\pm$ 0.5772	N=40 20.475 $\pm$ 1.0039	P=0.0514
SCC ($\times 10^3$) (cells/mL)	N=30 189.696 $\pm$ 161.290b	N=77 467.825 $\pm$ 100.675ab	N=23 716.100 $\pm$ 184.206aa	P=0.0985
Log ₁₀ SCC	2.044 $\pm$ 0.105b	2.295 $\pm$ 0.066ab	2.380 $\pm$ 0.120aa	P=0.0707

a, b, c; d; The differences between means represented by different letters in the same column are significant (P<0.05).

Conclusion

These findings suggest that proactive management of metabolic disorders is essential not only for improving milk quality but also for enhancing herd productivity. Future studies should focus on longitudinal monitoring of SCC in relation to nutritional interventions and disease management practices. This study highlights the significant influence of metabolic disorders, particularly ketosis and acidosis, on milk composition and production parameters in dairy cows. Ketosis was associated with elevated milk fat content and electrical conductivity, alongside increased milk yield, while most other compositional traits were reduced. In contrast, acidosis led to higher levels of milk protein, lactose, density, salt, and temperature, indicating distinct metabolic effects on milk traits. Although somatic cell counts were slightly higher in healthy cows compared to those with metabolic disorders, the difference was not statistically significant. These findings reinforce the complex interplay between metabolic health and milk quality, underscoring the need for early detection and effective management of subclinical metabolic conditions. Proactive nutritional strategies and herd monitoring are essential to mitigate the negative impacts of ketosis and acidosis, improve udder health, and sustain both milk quality and economic productivity in dairy herds.

References

- [1]. Haygert-Velho, I.M., Conceicao, G.M.D., Cosmam, L.C., Alessio, D.R., Busanello, M., Sippert, M.R., Damiani, C., Almeida, A.P.A. and Velho, J.P., 2018. Multivariate analysis relating milk production, milk composition, and seasons of the year. *Anais da Academia Brasileira de Ciências*, 90(04), pp.3839-3852.
- [2]. Zanon, T., Hörtenhuber, S., Fichter, G., Peratoner, G., Zollitsch, W., Gatterer, M., & Gauly, M. (2025). Effect of management system and dietary seasonal variability on environmental efficiency and human net food supply of

- mountain dairy farming systems. *Journal of Dairy Science*, 108(1), 597-610.
- [3]. Çınar, M., Serbester, U., Ceyhan, A., & Gorgulu, M. (2015). Effect of somatic cell count on milk yield and composition of first and second lactation dairy cows. *Italian Journal of Animal Science*, 14 (1), 3646.
 - [4]. Sharma, N., Singh, N., & Bhadwal, M. (2011). Relationship of somatic cell count and mastitis: An overview. *Animal Bioscience*, 24 (3), 429-438.
 - [5]. Ma, Y., Ryan, C., Barbano, D.M., Galton, D.M., Rudan, M.A., & Boor, K.J. (2000). Effects of somatic cell count on quality and shelf-life of pasteurized fluid milk. *Journal of Dairy Science*, 83 (2), 264-274.
 - [6]. Dejyong, T., Chanachai, K., Immak, N., Prarakamawongsa, T., Rukkwamsuk, T., Tago Pacheco, D. and Phimpraphai, W., 2022. An economic analysis of high milk somatic cell counts in dairy cattle in Chiang Mai, Thailand. *Frontiers in Veterinary Science*, 9, p.958163.
 - [7]. Koç, A. (2007). Daily milk yield, non-fat dry matter content and somatic cell count of Holstein-Friesian and Brown-Swiss cows. *Acta Veterinaria*, 57 (5-6), 523-535.
 - [8]. Koç, A. and Kizilkaya, K. 2009. Some factors influencing milk somatic cell count of Holstein Friesian and Brown Swiss cows under the Mediterranean climatic conditions. *Archives Animal Breeding*, 52(2), pp.124-133.
 - [9]. Kaygısız, A., & Karnak, İ. (2012). Kahramanmaraş'ta süt sığırı işlemlerinden toplanan çiğ süt örneklerinin somatik hücre sayısının AB normları ve subklinik mastitis bakımından değerlendirilmesi. *KSÜ Doğa Bilimleri Dergisi*, 15(3), 9-15.
 - [10]. Önal, A.R., Özkan, M., & Tuna, Y.T. (2021). Siyah Alaca süt sığırlarında mevsim ve laktasyon sırasının sütün bileşimi ve kalitesine etkisi. *Tekirdağ Ziraat Fakültesi Dergisi*, 18 (2), 368-374.
 - [11]. Kelly, A.L., Tiernan, D., O'sullivan, C., & Joyce, P. (2000). Correlation between bovine milk somatic cell count and polymorphonuclear leukocyte level for samples of bulk milk and milk from individual cows. *Journal of Dairy Science*, 83 (2), 300-304.
 - [12]. Olechnowicz, J., & Jaśkowski, J.M. (2012). Somatic cells count in cow's bulk tank milk. *Journal of Veterinary Medical Science*, 74 (6), 681-686.
 - [13]. Yalçın, H., & Çakmak, T. (2022). İnek sütlerinde somatik hücre sayısı ve bazı parametrelerin araştırılması. *Manas Journal of Agriculture Veterinary and Life Sciences*, 12 (1), 81-87.
 - [14]. Mama, M., Pechangou, E. A. P., Miegoué, E., Lemoufouet, J., & Tendonkeng, F. (2024). Reproductive Performances of SIMGOUD Crossbreed Cows and the Effect of Concentrate Feed Supplementation on the Production and Chemical Composition of Milk. *Journal of Applied Veterinary Science and Technology*, 5(2), 140-145.
 - [15]. Fekadu, B., Soryal, K., Zeng, S., Van Hekken, D., Bah, B. and Villaquiran, M., 2005. Changes in goat milk composition during lactation and their effect on yield and quality of hard and semi-hard cheeses. *Small Ruminant Research*, 59(1), pp.55-63.
 - [16]. Kirkeby, C., Toft, N., Schwarz, D., Farre, M., Nielsen, S.S., Zervens, L., Hechinger, S. and Halasa, T., 2020. Differential somatic cell count as an additional indicator for intramammary infections in dairy cows. *Journal of Dairy Science*, 103(2), pp.1759-1775.
 - [17]. Koç, A., 2015. Effects of Somatic Cell Count and Various Environmental Factors on. *Journal of Agricultural Sciences*, 21(3), pp.439-447.
 - [18]. Li, N., Richoux, R., Boutinaud, M., Martin, P. and Gagnaire, V., 2014. Role of somatic cells on dairy processes and products: a review. *Dairy Science & Technology*, 94, pp.517-538.
 - [19]. Otwinowska-Mindur, A., Ptak, E., Jagusiak, W., & Zarnecki, A. (2025). Genetic parameters for milk production traits of Simmental cows with random regression test-day model. *Animal*, 19(2), 101395.
 - [20]. FAO. (2014). Impact of mastitis in small scale dairy production systems. In Animal production and health working paper. No.13.
 - [21]. Hamadani, H., Khan, A.A., Banday, M.T., Ashraf, I., Handoo, N., Bashir, A. and Hamadani, A., 2013. Bovine mastitis-A disease of serious concern for dairy farmers. *International Journal of Livestock Research*, 3(1), pp.42-55.
 - [22]. Dairyman's digest. 2009. Why should you know about somatic cell counts?. Winter Issue.
 - [23]. Chernet, T.F., Mwai, O., Meseret, S., Negussie, E., Mrode, R., Tarekegn, G.M., Edea, Z., Gebreyohanes, G., Ekine-Dzivenu, C., Tera, A. and Tessema, T.S., 2024. Milk somatic cell count, composition and yield of multi-breed dairy cattle in Ethiopia. *Cogent Food & Agriculture*, 10(1), p.2421957.
 - [24]. Kul, E., Şahin, A., Atasever, S., Uğurlutepe, E. and Soydaner, M., 2019. The effects of somatic cell count on milk yield and milk composition in Holstein cows. *Veterinarski Arhiv*, 89(2), pp.143-154.
 - [25]. Ying, C., Yang, C.B. and Hsu, J.T., 2004. Relationship of somatic cell count, physical, chemical and enzymatic properties to the bacterial standard plate count in different breeds of dairy goats. *Asian-Australasian Journal of Animal Sciences*, 17(4), pp.554-559.
 - [26]. Diaz J R, Muelas R, Seura C, Peris C and Molina P 1996. Effect of mastitis on milk composition in Manchega ewes: preliminary results. In Somatic Cells and Milk of Small Ruminants, pp 305–309. EAA Publication no. 77.

- Wagen-ingen, The Netherlands: Wageningen Press.
- [27]. Lauri-Naviciute, V., Siugzdaite, J. and Urbsiene, D., 2004. Quality and composition of milk with different somatic cell counts in two breeds of dairy goats. *Medycyna Weterynaryjna*, 60(11), 1168-1170.
- [28]. Norman, H.D., Miller, R.H., Wright, J.R. and Wiggans, G.R., 2000. Herd and state means for somatic cell count from dairy herd improvement. *Journal of Dairy Science*, 83(12), pp.2782-2788.
- [29]. Çardak, A.D. (2016). Siyah-Alaca İneklerde somatik hücre sayısı, laktasyon sırası ve döneminin süt verimi ve süt bileşimine etkileri. *Harran Üniversitesi Veteriner Fakültesi Dergisi*, 5 (1), 34-39.
- [30]. SAS (1985). SAS User's Guide: Statistics, SAS institute Inc., Carry, NC, USA.
- [31]. Yoon, J.T., Lee, J.H., Kim, C.K., Chung, Y.C., & Kim, C.H. (2004). Effects of milk production, season, parity and lactation period on variations of milk urea nitrogen concentration and milk components of Holstein dairy cows. *Asian-Australasian Journal of Animal Sciences*. *Asian Australasian Association of Animal Production Societies*, 17 (4), 479-484.
- [32]. Deshapriya, R.M.C., Rahularaj, R. and Ransinghe, R.M.S.B.K., 2019. Mastitis, somatic cell count and milk quality: An overview. *Sri Lanka Veterinary Journal*, 66(1).
- [33]. Jiao, C., Wang, X., & Zhao, Z. Effect of corn stover pellet feed replacing partial silage on rumen microflora and serum metabolome of breeding cow. *Frontiers in Microbiology*, 16, 1533851.
- [34]. El-Sheikh, A.I., El-Tahawy, A.S. and Almathen, F., 2017. Influences of Body Condition Score and Somatic Cell on the Productivity and Economic Efficiency of the Dairy Cows with Special Highlighting on its Milk Constituents. *Journal Dairy Vet Anim Res*, 5(6), p.00160.
- [35]. Ermetin, O., Kul, E. and Okuyucu, I.C., 2024. The relationship of somatic cell count with milk yield and composition in different stages of lactation in Holstein cows. *Veterinarski Arhiv*, 94(1), pp.21-32.
- [36]. Östensson, K., 1993. Variations during lactation in total and differential leukocyte counts, N-acetyl-β-D-glucosaminidase, antitrypsin and serum albumin in foremilk and residual milk from non-infected quarters in the bovine. *Acta Veterinaria Scandinavica*, 34, pp.83-93.
- [37]. Dechow, C.D., Rogers, G.W., Cooper, J.B., Phelps, M.I. and Mosholder, A.L., 2007. Milk, fat, protein, somatic cell score, and days open among Holstein, Brown Swiss, and their crosses. *Journal of dairy science*, 90(7), 3542-3549.
- [38]. Çoban, O., Sabuncuoğlu, N. and Tuzemen, N., 2009. A study on relationships between somatic cell count (SCC) and some udder traits in dairy cows. *Journal of Animal and Veterinary Advances*, 8(1), pp.134-138.
- [39]. Sefidmazgi A.S., Amer P.R., 2015. Milk losses and quality payment associated with somatic cell counts under different management systems in an arid climate. *Canadian Journal of Animal Science*, 95, 351-360.
- [40]. Yang, W., Zhang, B., Xu, C., Zhang, H. and Xia, C., 2019. Effects of ketosis in dairy cows on blood biochemical parameters, milk yield and composition, and digestive capacity. *Journal of Veterinary Research*, 63(4), p.555.
- [41]. Kaygısız, A., 2023. Esmer Sığırlarda Somatik Hücre Sayısı ve Sütte Üre Miktarının Sütün Bileşimine Etkileri. *Palandöken Journal of Animal Sciences Technology and Economics*, 2(1), pp.1-6.
- [42]. İleri-Büyükoğlu, T., Şahinduran, Ş., Sezer, K. and Güldür, T., 2009. Evaluation of changes in serum lipoprotein and apolipoprotein patterns in cows with ketosis. *American journal of veterinary research*, 70(5), pp.563-570.

تأثير عدد الخلايا الجسدية على إنتاج الحليب وتركيبه في الأبقار السيمنتال في ظل الظروف شبه القاحلة في أربيل.

شيرين احسان عز الدين¹ علي كايسز²

¹ قسم الإنتاج الحيواني، كلية علوم الهندسة الزراعية، جامعة صلاح الدين، أربيل، العراق.
² قسم الإنتاج الحيواني، كلية الزراعة، جامعة كهرمانمراش سونجو امام، كهرمانمراش، تركيا.

الخلاصة

هدف هذه الدراسة هو تقييم آثار عدد الخلايا الجسدية على إنتاج الحليب وتركيبه في أبقار سيمنتال الحلوب. تم حلب الأبقار آلياً مرتين يومياً خلال هذه الفترة. تم أخذ عينات الحليب على فترات شهرية من كل بقرة أثناء الحلب المسائي بين أيلول 2024 ونيسان 2025. أثر التباين الشهري بشكل كبير على إنتاج الحليب وتركيبه ($P < 0.001$)، في حين لم يظهر عدد الخلايا الجسدية تأثيراً ذا دلالة إحصائية ($P = 0.1315$). لم يلاحظ أي فرق إحصائي في مستوى عدد الخلايا الجسدية ($P > 0.05$) بالنسبة لنسبة الدهون والبروتين والمواد الصلبة غير الدهنية واللاكتوز والكثافة والملح ونقطة التجمد والماء ودرجة حرارة الحليب والتوصيل الكهربائي للحليب. زاد عدد الخلايا الجسدية ($P < 0.001$) في الحليب ذي المستويات العالية من عدد الخلايا الجسدية. كانت نسبة الدهون في الحليب أعلى بشكل ملحوظ في الأبقار المصابة بالكتوزية ($P < 0.001$)، بينما زادت مستويات البروتين بشكل ملحوظ في الأبقار المصابة بالحمض ($P = 0.003$). تشير هذه الدراسة إلى أن ارتفاع عدد الخلايا الجسدية يؤثر سلباً ليس فقط على تركيبة الحليب ولكن أيضاً على إنتاج الحليب وجودته.

الكلمات المفتاحية: عدد الخلايا الجسدية، إنتاج الحليب، تركيب الحليب، الحمض، الكيتوزية.