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Compare The Nutritional Content of Fat of Row Cow Milk From Different Reason of Sikar District

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Abstract

The nutritional composition of raw cow milk, particularly its fat content, is influenced by multiple factors such as breed, diet, environmental conditions, and management practices. This study aimed to investigate and compare the seasonal and regional variations in the fat content of raw cow milk collected from different private dairies across the Sikar district of Rajasthan. Milk samples were collected during the summer, rainy, and winter seasons and analyzed within 24 hours of collection using milk analyzer machines. All samples were stored at 4°C prior to analysis to preserve their quality.

The findings revealed significant ($p \leq 0.05$) seasonal variation in milk fat content, while regional differences were non-significant ($p > 0.05$). The mean fat content was highest during the winter season (4.65 ± 0.0031 g/100g), followed by the rainy season (4.55 ± 0.0019 g/100g), and lowest during the summer season (3.91 ± 0.0019 g/100g). These results are consistent with previous studies reporting reduced milk fat in summer due to higher ambient temperatures and dietary changes that influence rumen acetate production. The observed seasonal differences may also be attributed to environmental temperature, feeding patterns, and physiological responses of cows to climatic stress.

Overall, the study concludes that seasonal variation significantly affects the fat content of cow milk, while geographical differences within the Sikar district do not. Understanding these patterns is crucial for dairy producers to optimize management practices, maintain milk quality, and ensure profitability.

Keywords: Cow milk, fat content, seasonal variation, Sikar district, Rajasthan, milk nutrition, environmental influence.

Introduction

The nutritional content of raw cow milk can vary depending on various factors, including the diet of the cows, environmental conditions, breed of cows and management practices. Common nutrients found in cow milk include proteins, carbohydrates, fats, vitamins and minerals.

Milk contains varying amounts of fats which provide energy and are essential for the absorption of fat-soluble vitamins. The type and quantity of fats in milk can be influenced by factors such as the breed of

cows, their diet, and management practices. Milk from cows that are fed on fresh grass or pasture may have a higher content of beneficial fatty acids such as omega-3 fatty acids compared to milk from cows that are fed on a grain-based diet.

This objective aimed to investigate and compare the nutritional composition of fat of raw cow milk obtained from different areas during different seasons. The nutritional content of raw cow milk can vary depending on factors such as the breed of the cow, the diet of the cow, and environmental factors, which may differ in different areas.

Material & Method

Milk samples of cows were collected from different areas (private dairies) of Sikar district, Rajasthan during summer, rainy and winter seasons to measure nutritional contentsof fat of raw milk samples of cow . All samples were analyzed within 24-hours to accomplish the objectives mentioned in the synopsis. Milk samples were kept in a refrigerator at 4°C till until analysis. Milk fat was determined by using milk analyzer machines.

Result & Discussion

Fat (g/100g) contents of milk samples (Mean ± SEM values) are presented in table 1 and depicted in Fig.1. Seasonal variation was observed to be significant ($p \leq 0.05$) in the milk samples collected from 20 areas of Sikar district. Mean value of fat observed during winter season was significantly ($p \leq 0.05$) higher than the respective mean values during rainy and summer seasons. Mean value obtained during summer season was significantly ($p \leq 0.05$) lowest. Mean values during rainy season exhibited a middle path. Nutritional contents were significantly influenced by season (Bara et al., 2023). Earlier researchers also mentioned that fat content becomes lower in summer. Many other scientists reported seasonal influence on fat in cows (Konwar and Sharma.1978; Sharma et al., 2002; Singh. 2008, Maheswari et al., 2018 and Lim et al., 2021). Some Alterations in milk fat with temperature change can be associated to changes in blood plasma lipids.

Table 2 represented fat contents of milk samples area wise in each season. In each season, area wise variation was non-significant ($p > 0.05$).

Bara et al. (2023) observed significant effect of season on fat content of cow. Earlier researchers also mentioned that fat content becomes lower in summer. Many other scientists reported seasonal influence on fat in cows (Konwar and Sharma.1978; Sharma et al., 2002; Singh. 2008, Maheswari et al., 2018 and Lim et al., 2021).

In a study, late-season milk from a seasonal-calving system had unique properties, incorporating the highest protein and fat content, the lowest lactose content, and altered protein and salt composition (Auldist et al.,1998).

Researchers have pointed out lower level of fat in summer season comparing to any other season and winter showed the highest amount of milk fat (Ayub et al., 2007). These differences between summer and winter may be attributed to long days result in a lower fat concentration and reduced rate secretion of fat. It can be deduced that seasonal changes have influences on the milk composition. The fat is the most changeable parameter among the major milk components and its synthesis is affected by many factors

especially ambient factors (Bayril et al., 2010). When environmental temperature is increased the milk fat begins to decrease. Since milk fat synthesis depends on the supply of acetate from the rumen, any feeding regime, such as high grain feeding which lowers the production of rumen acetate, will also lower the fat content of milk during summer season (Yildirim and Cimen, 2009).

Fat is an important component as milk prices are also based on the fat content of milk, mainly fat percentages (Sarkar et al., 2006). Several environmental factors can affect milk constituents as well as milk yields at successive stages of lactation and at completion of lactation and it becomes necessary to determine their relative importance so that dairy person can optimize their management practices, increase milk production, maintain milk quality, and ensure sustainability and profitability by recognizing and adapting to these effects.

It can be stated that changes in milk fat were significant ($p \leq 0.05$) due to seasonal influence. Effect of area was non-significant ($p > 0.05$) on milk fat values.

Fig. 1 : Changes in fat (g/100g) content of milk samples during summer, rainy and winter seasons

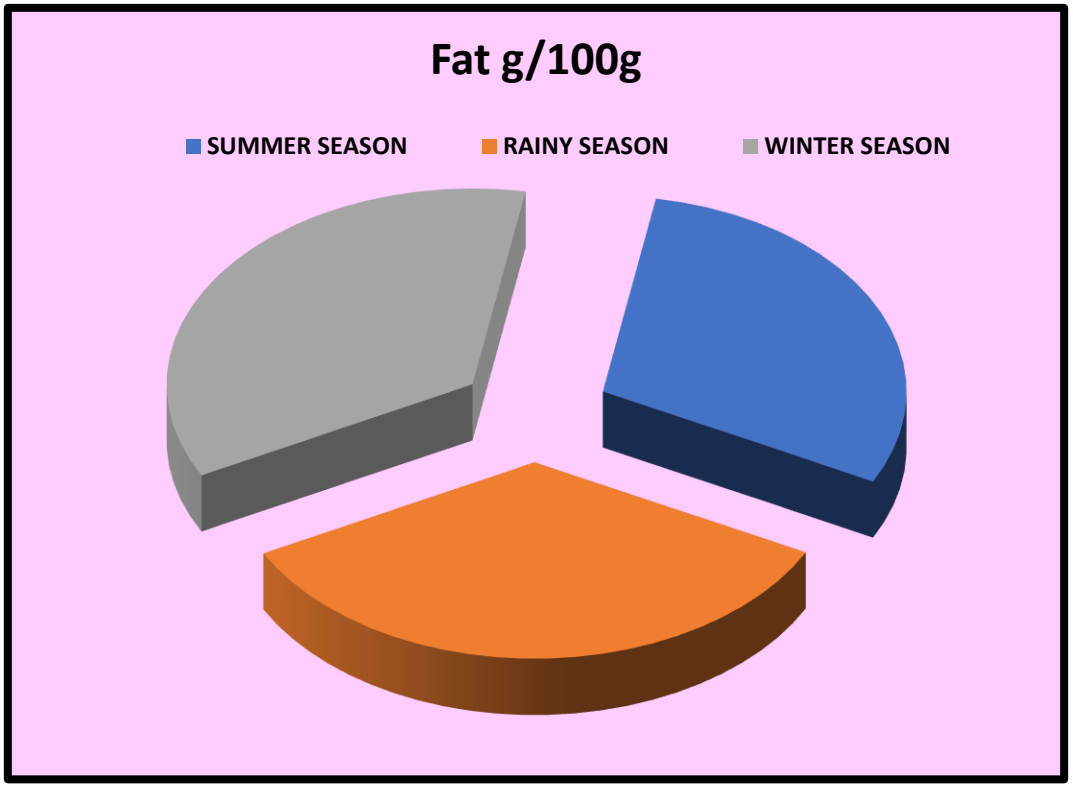

Table 1: Fat (g/100g) content of milk samples during summer, rainy and winter

Seasons (N=100)

Season	Mean ± SEM values of milk Fat (g/100g)
Summer	3.91^{b} ± 0.0019
Rainy	4.55^{b} ± 0.0019
Winter	4.65^{b} ±0.0031

N= Number of milk samples

Means superscribed by letter " b " differ significantly ($p \leq 0.05$) from each other

Table 2: Fat content of milk samples (1-25) during different seasons and from different areas/ dairies of Sikar district

Milk samples	Area/Dairy	Fat (g/100g) of milk samples during different seasons		
		Summer	Rainy	Winter
1. 1	1	3.92	4.55	4.65
2.		3.90	4.54	4.69
3.		3.94	4.56	4.61
4.		3.91	4.53	4.70
5.		3.90	4.57	4.60
6.	2	3.92	4.58	4.66

7.		3.91	4.52	4.64
8.		3.93	4.53	4.61
9.		3.92	4.56	4.65
10.		3.91	4.58	4.69
11.	3	3.90	4.57	4.61
12.		3.93	4.52	4.60
13.		3.92	4.55	4.67
14.		3.94	4.54	4.65
15.		3.92	4.55	4.66
16.	4	3.91	4.53	4.64
17.		3.93	4.56	4.63
18.		3.92	4.58	4.65
19.		3.92	4.57	4.69
20.		3.92	4.52	4.70
21.	5	3.94	4.55	4.66
22.		3.91	4.54	4.64
23.		3.92	4.53	4.69
24.		3.93	4.58	4.61
25.		3.92	4.55	4.65

Table 10: Fat content of milk samples (26-50) during different seasons and from different areas of Sikar district

Milk samples	Area/Dairy	Fat (g/100g) of milk samples during different seasons		
		Summer	Rainy	Winter
26. 1	1	3.95	4.65	4.60
27.		3.90	4.66	4.66
28.		3.94	4.64	4.64

29.		3.91	4.67	4.61
30.		3.90	4.63	4.65
31.	2	3.92	4.66	4.69
32.		3.91	4.65	4.65
33.		3.93	4.67	4.69
34.		3.92	4.64	4.61
35.		3.91	4.65	4.70
36.	3	3.90	4.66	4.61
37.		3.93	4.63	4.60
38.		3.92	4.65	4.67
39.		3.94	4.66	4.65
40.		3.92	4.64	4.66
41.	4	3.91	4.65	4.64
42.		3.93	4.66	4.63
43.		3.94	4.64	4.65
44.		3.89	4.62	4.69
45.		3.92	4.68	4.70
46.	5	3.94	4.65	4.66
47.		3.91	4.62	4.64
48.		3.92	4.65	4.69
49.		3.93	4.68	4.61
50.		3.89	4.64	4.65

Table 10: Fat content of milk samples (51-75) during different seasons and from different areas of Sikar district

Milk samples	Area/Dairy	Fat (g/100g) of milk samples during different seasons		
		Summer	Rainy	Winter
51. 1	11	3.90	4.55	4.66
52.		3.94	4.54	4.70
53.		3.91	4.56	4.66
54.		3.90	4.53	4.64
55.		3.92	4.57	4.69
56.	12	3.91	4.57	4.61
57.		3.93	4.52	4.65
58.		3.92	4.55	4.69
59.		3.91	4.54	4.61
60.		3.90	4.55	4.70
61.	13	3.93	4.53	4.60
62.		3.92	4.56	4.66
63.		3.94	4.58	4.64
64.		3.92	4.57	4.61
65.		3.91	4.52	4.64
66.	14	3.93	4.55	4.69
67.		3.94	4.54	4.61
68.		3.89	4.53	4.60
69.		3.92	4.58	4.67
70.		3.94	4.55	4.65
71.	15	3.91	4.58	4.66
72.		3.92	4.52	4.64
73.		3.93	4.53	4.63

74.		3.89	4.56	4.65
75.		3.95	4.58	4.69

Table 10: Fat content of milk samples (76-100) during different seasons and from different areas of Sikar district

Milk samples	Area/Dairy	Fat (g/100g) of milk samples during different seasons		
		Summer	Rainy	Winter
76. 1	16	3.91	4.54	4.61
77.		3.90	4.56	4.70
78.		3.92	4.53	4.60
79.		3.95	4.57	4.66
80.		3.90	4.58	4.64
81.	17	3.94	4.52	4.61
82.		3.91	4.53	4.65
83.		3.93	4.56	4.69
84.		3.92	4.58	4.61
85.		3.91	4.57	4.60
86.	18	3.90	4.52	4.67
87.		3.93	4.54	4.65
88.		3.92	4.55	4.66
89.		3.94	4.53	4.64
90.		3.92	4.56	4.63
91.	19	3.91	4.58	4.65
92.		3.93	4.57	4.69
93.		3.94	4.52	4.70
94.		3.89	4.55	4.66
95.		3.92	4.54	4.64

96.	20	3.94	4.53	4.69
97.		3.91	4.55	4.61
98.		3.92	4.58	4.65
99.		3.93	4.55	4.65
100.		3.89	4.55	4.69

Discussion

The present study investigated the seasonal and regional variations in the fat content of raw cow milk collected from various dairies in the Sikar district of Rajasthan. The findings demonstrated that seasonal changes had a significant ($p \leq 0.05$) effect on the fat composition of milk, while area-wise variations were found to be non-significant ($p > 0.05$). These results align with earlier studies that have consistently shown the influence of environmental and dietary factors on milk fat synthesis (Konwar & Sharma, 1978; Sharma et al., 2002; Singh, 2008; Maheswari et al., 2018; Lim et al., 2021).

The mean fat percentage was recorded as 3.91 g/100g during summer, 4.55 g/100g during the rainy season, and 4.65 g/100g during winter. The highest fat content during winter can be attributed to favorable climatic conditions, improved feed intake, and reduced heat stress on the animals. Cold weather promotes better metabolic efficiency and energy utilization, enhancing milk fat synthesis. Conversely, during the summer season, elevated ambient temperatures and humidity levels cause physiological stress in cows, reducing feed intake, rumen fermentation efficiency, and acetate production—key precursors for milk fat synthesis. These findings are consistent with reports by Bara et al. (2023), Bayril et al. (2010), and Yildirim & Cimen (2009), who observed that heat stress leads to a decline in milk fat due to changes in metabolic and digestive functions.

The moderate fat levels during the rainy season may be linked to transitional feeding patterns and the availability of green fodder. Pasture-based feeding tends to increase the proportion of unsaturated fatty acids, including omega-3 fatty acids, thereby improving the nutritional profile of milk, as also suggested by Auldist et al. (1998) and Ayub et al. (2007). The non-significant regional variations indicate that management practices and feeding regimes were largely uniform across dairies within the Sikar district.

The observed seasonal variations emphasize the importance of environmental factors on milk composition. Since milk fat is a major determinant of milk's economic value and quality, understanding these fluctuations is essential for dairy farmers. Adjustments in feeding strategies, thermal comfort management, and herd nutrition planning during adverse climatic conditions can help sustain milk quality throughout the year. These results also provide valuable insights for milk processors and policymakers in designing pricing systems that consider seasonal variations in fat content.

Conclusion

The study clearly demonstrates that the fat content of raw cow milk is significantly influenced by seasonal variations, while regional differences within the Sikar district are minimal. The highest milk fat levels were observed during the winter season, followed by the rainy and summer seasons. Seasonal temperature fluctuations, feed composition, and physiological stress are the major factors contributing to these differences.

The findings highlight the need for implementing season-specific management strategies to maintain consistent milk quality and optimize production. Providing balanced nutrition, adequate cooling systems during summer, and access to quality forage can mitigate seasonal losses in milk fat. Moreover, since milk pricing and consumer preference are closely related to fat percentage, such insights can help improve economic returns for dairy farmers and ensure sustainable dairy management.

In conclusion, this study underscores the importance of environmental and nutritional management in maintaining milk composition and contributes valuable baseline data for the Sikar district, which can serve as a reference for future studies on regional dairy quality assessment.

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