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Comparative Assessment of Fat and SNF Contents of Milk of Jersey and Holstein Friesian Cattle

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Abstract:
Background*: Dairying plays a major role in Indian rural economy. Indigenous cattle are being bred with exotic germplasm to increase the milk yield. Jersey and Holstein Friesian crossbreeding is being practiced in the Kerala state to increase the milk production. Farmers need to know which breeds is suitable for their location in terms of higher production.*
Materials and Methods*:The present study was conducted objective of comparing the fat, and SNF contents of milk of Jersey and Holstein Friesian breeds in the Idukki district of Kerala to make recommendation for the breed suitable for this location.*
Results*:The mean morning milk yield in the Jersey cattle ranged from 4.46±0.10 litres to 5.36±0.14 litres. High morning milk yield was observed during the month of May. The mean evening milk yield in the jersey cattle ranged from 3.26±0.12 litres to 4.15±0.10 litres. High evening milk yield was observed during the month of May. The mean morning milk yield in the HF cattle ranged from 6.39±0.1 litres to 7.52±0.13 litres. High morning milk yield was observed during the month of May. The mean evening milk yield in the HF cattle ranged from 5.21±0.11 litres to 6.14±0.13 litres. High evening milk yield was observed during the month of May. The mean morning milk fat per cent in the Jersey cattle ranged from 3.92±0.10 to 4.46±0.10. The mean evening milk fat per cent in the Jersey cattle ranged from 4.55 ±0.10 to 4.86±0.09. The mean morning milk fat per cent in the HF cattle ranged from 3.12±0.09 to 3.39 ±0.09. The mean evening milk fat per cent in the HF cattle ranged from 3.54±0.10 to 3.81±0.10.Highest milk fat per cent (4.86±0.09) was observed in the Jersey cow evening milk. The mean morning milk SNF per cent in the Jersey cattle ranged from 7.96±0.11 to 8041±0.11. The mean evening milk SNF per cent in the Jersey cattle ranged from 7.85 ±0.10 to 8.16±0.12. The mean morning milk SNF per cent in the HF cattle ranged from 7.33±0.10 to 8.00 ±0.12. The mean evening milk SNF per cent in the HF cattle ranged from 7.23±0.10 to 7.85±0.11. Highest milk SNF per cent (8.41±0.11) was observed in the Jersey cow morning milk.*
Conclusion: *It could be concluded that HF cattle is most suitable for milk production in the Idiki district of Kerala in terms of higher milk production, optimum fat and SNF percentages in milk. This milk is suitable for direct consumption through direct sale to the consumer. The SNF content of the milk can be improved by suitable feeding and environmental management strategies.*

Key Word*:* SNF,Fat, Jersey cow, milk, Holstein Friesian , breed

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I. Introduction

Dairying plays a major role in Indian rural economy. Dairying in India is more than a business; it has broader social and economic dimensions. Currently, India is the world's largest producer (209.9 million MT in 2020-21) and consumer of milk accounting for 24 % of the world milk production (Vision 2022, 2019). The exotic and cross bred animals contribute nearly 26.19 % of the total cattle population (192.49 million) in India (20 Livestock Census, 2019). Holstein Friesian crossbred cows are one of the high yielding categories of cattle in India (Rajib et al 2020)

The minimum standards for market milks are fixed for fat and SNF contents to ensure quality milk supply to the consumers and to prevent adulteration of milk. Various grades of market milk are supplied to the consumer after standardization to the prescribed levels of fat and SNF content of milk. Indigenous cattle are being bred with exotic germplasm to increase the milk yield. Jersey and Holstein Friesian crossbreeding is being practiced in the Kerala state to increase the milk production. As the exotic blood level increases there is an increase in the milk yield of the crossbred animals if the animals are maintained in high plane of nutrition. In the underfed animals the milk yield and SNF contents in milk are low especially in the Holstein Fresian Crossbreeds and farmers suffer due to lower price is paid for the milk. Farmers need to know which breeds is suitable for

their location in terms of better price for the milk produced.The present study was conducted objective of comparing the fat, and SNF contents of milk of Jersey and Holstein Friesian breeds in the Idukki district of Kerala to make recommendation for the breed suitable for this location.

II. Review of Literature

Milk composition is influenced by many factors that include nutrition, parity, stage of lactation and breed (Carroll et al 2006).

2.1 Milk yield of Jersey and Holstein Friesian cows

Finely Ground Corn had (Poore, et. al. 1993) higher efficiency of conversion of feed to milk. Increase in milk yield may be attributed to increase in nutrient availability/digestibility in the total tract as indicated by Knowlton et. al.1995. Similar results were recorded when mid lactation animals were fed with high concentrate diet. Increased ruminally degradable (Drackley et. al. 2003) starch improves lactational performance probably because of higher production of VFA and greater ruminal bacterial yields. Blood glucose concentrations (Drackley et. al.2003) was found to be greater 4 h post-feeding, suggesting that the propionate supply and energy balance were greater for cow. The average milk yield in the jersey cattle was 9.78±0.14 litres per day whereas the yield for the Holstein Friesian cow was 10.22±0.14 litres per day (Kumaresan et al 2008).

The first lactation cows had lowest milk production and highest production occurred in 5 parities (Wondifraw et al., 2013). The average daily milk yield of Jersey crossbred cattle was 9.78 ± 0.14 litres. There was an increase in milk yield corresponding to increase in the level of FGDC in the diet of the Jersey crossbred cattle indicating that the animals were suffering from energy malnutrition. Parity may potentially affect the nutrient digestibility and productivity of lactating dairy cows. Study of Mingoas et al. (2017) showed that udder size is strong and positively correlated to milk yield. Overall milk yield (kg) in primiparous (8.57±0.08 kg) and multiparous (11.22 ± 0.21 kg) cows showed significant (P<0.01) between the group. The highest milk yield was noted during 4 fortnight (8.81 ± 0.20 kg) and lowest during 1 fortnight (8.33±0.10 kg) in primiparous cows, however it was highest during 3 fortnight (11.79±0.38 kg) and lowest during 1 fortnight (10.29 ± 0.38 kg) in multiparous cows (Rajib Kro et al. 2020).

2.2 Fat content of milk of Jersey and Holstein Friesian cattle

When the level of FGDC is increased in the diet there was a decrease in the fat percentage of milk. The decrease in the fat percentage was significant between THF3 and THF4. Similar observations were made by Drackley et. al. (2003). The fat percentage of the crossbred Jersey cow milk ranged from 3.0 to 5.2 per cent. The mean high (4.61± 0.08) fat content of Jersey crossbred milk was noticed during the month of January 2006 and mean low fat (4.05 ± 0.08) content of milk was observed during the month of April 2006 when the mean atmospheric temperature was around 40°C. About 18.21 Per cent of the samples had less than the standard prescribed for cow milk i.e. 3.5 per cent fat (Kumaresan et. al.2008). cent. The high mean fat content (3.96 ± 0.10) was observed during the month of January 2006 and low mean (3.60 ± 0.07) fat content could be noticed during the month of May 2006. About 26.27 per cent of the HF cross bred milk samples had less than 3.5 per cent fat (Kumaresan et. al. 2008). Milk fat and protein levels were more in advance parities indicating significant effect of parity on milk composition (Yadav et al., 2013). The overall milk fat (%) was significantly (P<0.01)higher in primiparous (3.83±0.09%) as compared to multiparous (3.47±0.09%) cows. Furthermore, the fat (%)was found in decreasing trend from 1 to 4 fortnight (4.27 ±0.11, 3.85±0.11, 3.70±0.11, 3.50±0.17%) in primiparous cows, similar trend was observed from 1 to 3 fortnight (3.80 ± 0.19, 3.40±0.14, 3.28±0.13%) and a slight increase on 4 fortnight (3.40±0.18%) in multiparous cows (Rajib Kro et al.2020).

2.3. Solids not fat (SNF) content of milk of Jersey and Holstein Friesian cattle

A large number of studies have indicated that the per cent SNF to increase when the plane of energy intake is elevated (Burt, 1957). Improved microbial (Hoogendoorn and Grieve,1969) protein yield might have improved the milk Protein precursors in turn SNF content in the milk. There was a significant (P <0.01) increase in the milk yield of the HF crossbreds to increase in the FGDC content in their diet.

The SNF content of Jersey crossbred cattle milk was 8.13 ± 0.02 in the control milk was 8.43 ± 0.01. As the grain level in the diet is increased there was corresponding increase in the SNF percentage of milk. Increase in the SNF content was statistically significant between treatments (Kumaresan et. al.2008). As the level of FGDC is increased in the diet there was significant (P <0.01) increase in the SNF per cent. The SNF percentage was significant between the treatments also. Similar response of was observed for HF mid lactation cows to fed with high concentrate diet (Kumaresan et. al. 2008). The percentages of milk protein and SNF were significantly higher when the cows were fed rations with the higher energy. Parity affects the SNF and protein yields (Sudhakar et al., 2013).

The overall SNF (%) was higher in multiparous as compared to primiparous cows (7.87±0.05 vs 7.84±0.04%) though it was statistically not-significant. The fortnights' observation of SNF (%) of the groups was also not-significantly different in both the groups. Parity showed no significant effect on the SNF-constituent of milk of HF crossbred cows (Rajib Kro et al. 2020)

III. MATERIALS AND METHODS

This experiment was carried out to find out the suitable breed for milk production in the Idiki district of Kerala. Milk samples (50 each from Jersey and Holstein Friesian crossbred cattle) were collected and analysed immediately for fat and SNF contents.

3.1 MATERIALS

3.1.1 Selection of cows

Cows belong to Jersey and Holstein Friesian breeds were identified based on their appearance. Cows which are identical in age, weight, plane of nutrition, and stage of lactation were carefully selected for this study. 50 each from Jersey and HF cows in the second lactation and in around 65-70 days in lactation were identified. The weight of the Jersey cows ranged from 250-300 kgs and the weight of the HF cow ranged from 300-350kgs. Animals were fed with 25-30kg Hybrid Napier grass and 4-5kg paddy straw. Concentrate feed was recommended to the animals at the rate of 300g/litre of milk production.

3.1.2 Collection of milk samples

Milk samples from individual animals were collected in the morning and evening fortnightly during the months of May to July 2022 in a clean sample bottle and immediately analysed for the fat and SNF contents.

3.2 METHODS

3.2.1 Recording of the milk yield

Milk yield in litres was measured separately for Jersey and HF cattle both morning and evening and results were recorded.

3.2.2 Analysis of milk fat

Analysis of fat content of milk was carried out using ultrasonic milk analyser calibrated using Gerber's method (ISI: 1224 - Part I 1977) values**.**

3.2.3 Analysis of solids not fat content

The SNF content of the milk was analyzed by gravimetric method by subtracting fat from the total solids. Total solids content was measured by a gravimetric procedure in which aliquots of whole milk were weighed before and after drying at 100°C.

3.2.4 Statistical analysis

The data were statistically analyzed by ANOVA as described by Snedecor and Cochran (1989) using Microsoft Excel 2007 software.

IV. RESULTS

The data pertaining to the milk yield, milk fat milk solids not fat contents of milk of jersey and HF cattle maintained in the Idiki district of Kerala is presented in this chapter.

4.1 Milk yield of Jersey and HF cattle

The results pertaining to the milk yield of the jersey and HF cattle is presented in table 1.

Table 1 milk yield of Jersey and HF cattle

Breed	Month					
	May 2022		June 2022		July 2022	
	Morning	Evening	Morning	Evening	Morning	Evening
Jersey	5.36 ± 0.14^{fA}	4.15 ± 0.10^{cA}	5.03 ± 0.11^{eA}	$4.00.+0.11^{bA}$	4.46 ± 0.10^{dA}	3.26 ± 0.12^{aA}
HF	7.52 ± 0.13^{fB}	6.14 ± 0.13^{cB}	7.01 ± 0.11^{eB}	6.03 ± 0.11^{bB}	6.39 ± 0.12^{dB}	5.21 ± 0.11^{aB}

Mean ± SE values (n=100) with different lowercase superscripts between column differ significantly (P<0.01)
Mean ± SE values(n=100) with different uppercase superscripts between rows differ significantly (P<0.01)

The mean morning milk yield in the jersey cattle ranged from 4.46±0.10 litres to 5.36±0.14 litres. High morning milk yield was observed during the month of May. The mean evening milk yield in the jersey cattle ranged from 3.26±0.12 litres to 4.15±0.10 litres. High evening milk yield was observed during the month of

May.The mean morning milk yield in the HF cattle ranged from 6.39±0.1 litres to 7.52±0.13 litres. High morning milk yield was observed during the month of May. The mean evening milk yield in the HF cattle ranged from 5.21±0.11 litres to 6.14±0.13 litres. High evening milk yield was observed during the month of May.

4.2. Fat content of milk of Jersey and HF cattle

The results pertaining to the milk fat per cent of the Jersey and HF cattle is presented in table 2

Table 2 Fat content of milk of Jersey and HF cattle

Breed	Month					
	May 2022		June 2022		July 2022	
	Morning	Evening	Morning	Evening	Morning	Evening
Jersey	3.92 ± 0.10^{aB}	4.55 ± 0.10^{dB}	4.06 ± 0.09^{bB}	4.75 ± 0.08^{eB}	4.46 ± 0.10^{cB}	4.86 ± 0.09^{fB}
HF	3.12 ± 0.09^{aA}	3.54 ± 0.10^{dA}	3.21 ± 0.10^{bA}	3.63 ± 0.09^{eA}	3.39 ± 0.09^{cA}	3.81 ± 0.10^{fA}

Mean ± SE values (n=100) with different lowercase superscripts between column differ significantly (P<0.01)
Mean ± SE values(n=100) with different uppercase superscripts between rows differ significantly (P<0.01)

The mean morning milk fat per cent in the Jersey cattle ranged from 3.92±0.10 to 4.46±0.10. The mean evening milk fat per cent in the Jersey cattle ranged from 4.55 ±0.10 to 4.86±0.09. The mean morning milk fat per cent in the HF cattle ranged from 3.12±0.09 to 3.39 ±0.09. The mean evening milk fat per cent in the HF cattle ranged from 3.54±0.10 to 3.81±0.10.Highest milk fat per cent (4.86±0.09) was observed in the Jersey cow evening milk.

4.3 SNF content of milk of Jersey and HF cattle

The results pertaining to the milk SNF per cent of the Jersey and HF cattle is presented in table 3

Table 3 SNF content of milk of Jersey and HF cattle

Breed	Month					
	May 2022		June 2022		July 2022	
	Morning	Evening	Morning	Evening	Morning	Evening
Jersey	7.96 ± 0.11^{cB}	7.85 ± 0.10^{aB}	8.02 ± 0.12^{dB}	7.95 ± 0.10^{bB}	8.41 ± 0.11^{fB}	8.16 ± 0.12^{eB}
HF	7.33 ± 0.10^{bA}	7.23 ± 0.10^{aA}	7.85 ± 0.11^{dA}	7.63 ± 0.11^{cA}	8.00 ± 0.12^{eA}	7.85 ± 0.11^{dA}

Mean ± SE values (n=100) with different lowercase superscripts between column differ significantly (P<0.01)
Mean ± SE values(n=100) with different uppercase superscripts between rows differ significantly (P<0.01)

The mean morning milk SNF per cent in the Jersey cattle ranged from 7.96±0.11 to 8041±0.11. The mean evening milk SNF per cent in the Jersey cattle ranged from 7.85 ±0.10 to 8.16±0.12. The mean morning milk SNF per cent in the HF cattle ranged from 7.33±0.10 to 8.00 ±0.12. The mean evening milk SNF per cent in the HF cattle ranged from 7.23±0.10 to 7.85±0.11.Highest milk SNF per cent (8.41±0.11) was observed in the Jersey cow morning milk.

V. DISCUSSION

The results of milk yield, fat and SNF per cent of the milk of Jersey and HF cattle reared in Idiki district of kerala is discussed in this chapter.

5.1 Milk yield of Jersey and HF cattle

The statistical analysis of the results of milk yield of Jersey and HF cattle revealed significant differences between morning and evening milk yield. The morning milk yield was significantly (P<0.01) higher than the evening milk yield. This may be attributed to difference in the interval between milkings. Longer the interval higher will be the milk yield.

Significant (P<0.01) difference was also noticed between Jersey and HF breeds in milk yield. Highest milk production observed in HF cattle may be attributed to its breed character viz. huge animal, large udder, high feed consumption. The results agree with the reports of Kumaresan et al 2008 and Rajib Kro et al. 2020.

5.2. Fat content of milk of Jersey and HF cattle

The statistical analysis of the results of milk fat per cent of Jersey and HF cattle revealed significant differences between morning and evening milkings. The morning milk fat per cent was significantly (P<0.01) lower than the evening milk fat per cent. This may be attributed to difference in the interval between milkings. Longer the interval lower will be the milk fat per cent of milk.

Significant (P<0.01) difference was also noticed between Jersey and HF breeds in milk yield. Highest milk fat per cent observed in Jersey cattle may be attributed to its breed character. As the milk yield decreases there was increase in the fat per cent of milk.

The results closely agree with the findings of Kumaresan et al (2008).

5.3 SNF content of milk of Jersey and HF cattle

The statistical analysis of the results of milk SNF per cent of Jersey and HF cattle revealed significant differences between morning and evening milkings. The morning milk SNF per cent was significantly (P<0.01) higher than the evening milk SNF per cent. This may be attributed to difference in the interval between milkings. Shorter the interval lower will be the milk SNF per cent of milk.

Significant (P<0.01) difference was also noticed between Jersey and HF breeds in milk yield. Highest milk SNF per cent observed in Jersey cattle may be attributed to its breed character. As the milk yield is low there was increase in the SNF per cent of milk. The results closely agree with the findings of Kumaresan et al 2008 and Rajib Kro et al. 2020 .

VI. SUMMARY AND CONCLUSION

Dairying plays a major role in Indian rural economy. The minimum standards for market milks are fixed for fat and SNF contents to ensure quality milk supply to the consumers and to prevent adulteration of milk. Indigenous cattle are being bred with exotic germplasm to increase the milk yield. Jersey and Holstein Friesian crossbreeding is being practiced in the Kerala state to increase the milk production. Farmers need to know which breeds is suitable for their location in terms of better price for the milk produced. The present study was conducted objective of comparing the fat, and SNF contents of milk of Jersey and Holstein Friesian breeds in the Idukki district of Kerala to make recommendation for the breed suitable for this location. The milk yield of both breeds was also recorded.

The mean morning milk yield in the jersey cattle ranged from 4.46±0.10 litres to 5.36±0.14 litres. High morning milk yield was observed during the month of May. The mean evening milk yield in the jersey cattle ranged from 3.26±0.12 litres to 4.15±0.10 litres. High evening milk yield was observed during the month of May. The mean morning milk yield in the HF cattle ranged from 6.39±0.1 litres to 7.52±0.13 litres. High morning milk yield was observed during the month of May. The mean evening milk yield in the HF cattle ranged from 5.21±0.11 litres to 6.14±0.13 litres. High evening milk yield was observed during the month of May. The mean morning milk fat per cent in the Jersey cattle ranged from 3.92±0.10 to 4.46±0.10. The mean evening milk fat per cent in the Jersey cattle ranged from 4.55 ±0.10 to 4.86±0.09.

The mean morning milk fat per cent in the HF cattle ranged from 3.12±0.09 to 3.39 ±0.09. The mean evening milk fat per cent in the HF cattle ranged from 3.54±0.10 to 3.81±0.10.Highest milk fat per cent (4.86±0.09) was observed in the Jersey cow evening milk. The mean morning milk SNF per cent in the Jersey cattle ranged from 7.96±0.11 to 8041±0.11. The mean evening milk SNF per cent in the Jersey cattle ranged from 7.85 ±0.10 to 8.16±0.12. The mean morning milk SNF per cent in the HF cattle ranged from 7.33±0.10 to 8.00 ±0.12. The mean evening milk SNF per cent in the HF cattle ranged from 7.23±0.10 to 7.85±0.11. Highest milk SNF per cent (8.41±0.11) was observed in the Jersey cow morning milk.

It could be concluded that HF cattle is most suitable for milk production in the Idukki district of Kerala in terms of higher milk production, optimum fat and SNF percentages in milk. This milk is suitable for direct consumption through direct sale to the consumer. The SNF content of the milk can be improved by suitable feeding and environmental management strategies.

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