CB Anjali
Department of Dairy Science, College of Veterinary and Animal Sciences, Mannuthy, Thrissur, Kerala, India

CT Sathian
Department of Dairy Science, College of Veterinary and Animal Sciences, Mannuthy, Thrissur, Kerala, India

R Geetha
Department of Dairy Science, College of Veterinary and Animal Sciences, Mannuthy, Thrissur, Kerala, India

K Radha
Department of Dairy Science, College of Veterinary and Animal Sciences, Mannuthy, Thrissur, Kerala, India

SJ Bunglavan
Department of Animal Nutrition, College of Veterinary and Animal Sciences, Pookode, Wayanad, Kerala, India

KA Mercy
Department of Statistics, College of Veterinary and Animal Sciences, Mannuthy, Thrissur, Kerala, India

Impact of stage of lactation on milk constituents of crossbred cow milk in different category of SNF in Thrissur district, Kerala

CB Anjali, CT Sathian, R Geetha, K Radha, SJ Bunglavan and KA Mercy

Abstract
The current study was done for evaluate the influence of stages of lactation on fat, protein, lactose, total solids and SNF of cow milk in different category of SNF among the crossbred cows in Thrissur district. The stage of lactation had a significant influence on fat per cent and total solids per cent ($P<0.05$) in case of milk samples with SNF < 8.3 percent. For milk samples with SNF > 8.3 per cent stage of lactation had no significant influence on any of the milk constituents.

Keywords: stage of lactation, SNF, crossbred cows, Thrissur district, Kerala

1. Introduction
Seventy percent of the Indian population is engaged directly or indirectly in agriculture. Cattle rearing and dairying go hand in hand with agriculture and it helps to improve the socio-economic conditions of the farmers. It provides continuous and regular employment to the farmer. Indian dairy industry is not organized as in developed countries and organized dairy farms are very few in number. The main endeavor of the Indian dairy industry is to enhance milk production and upgrade milk processing using innovative technologies. It stands as first in the world.

In general the composition of cow milk constitutes major and minor constituents. The major constituents consist of water, fat, protein, lactose and total ash. The minor constituents include phospholipids, sterols, enzymes, pigments etc. Milk contains all these nutrients in an easily digestible and assimilable form, which made the milk, is a complete food for human beings.

The composition of cow milk and its production per lactation are influenced by a large number of factors; however, the most important factors are breed, nutrition, health of the animals, environment and the number and stage of lactation. Stage of lactation can be divide as early lactation period (14- 100 days), mid lactation period (100-200 days) and late lactation period (200- 360 days). It has been evident that lactation stage affects the chemical composition of produced milk. The current study was design to assess the impact of stage of lactation on milk constituents.

2. Materials and Methods
Milk samples were collected from two sources 1) cows maintained at University Livestock Farm and Fodder Research Development Scheme, KVASU, Mannuthy, Thrissur (150) and from 124 households of Thrissur district after proper mixing of morning milk. The samples were then stored at 4 ℃ for further analysis.

Samples were grouped on the basis of stage of lactation, milk fat and SNF content. About 100ml of raw milk was collected. Three milk samples of individual cows were collected at three days interval. The samples collected in sample bottles kept in ice bath were immediately transported to the laboratory.

Milk fat percentage was estimated by Gerber method as per the procedure described in BIS (1981) [1]. Total solids percentage of milk was estimated by the Gravimetric method described in BIS (1981) [1]. Total protein percentage of milk was estimated by Kjeldahl method described in BIS (1981) [1] using Pelican Kjeldahl apparatus. Milk lactose percentage of milk was estimated by Lane-Eynon method described in BIS (1981) [1]. Solids-not-fat content of milk was determined by the method described in BIS (1981) [1] by finding the difference between total solids and fat content of milk. The data obtained were subjected to statistical analysis following procedure described by Snedecor and Cochran (1994) [6] using the SPSS

Correspondence
CB Anjali
Department of Dairy Science, College of Veterinary and Animal Sciences, Mannuthy, Thrissur, Kerala, India

software version 24.0.

3. Results and Discussion
A total of 274 samples were analysed. Samples were grouped on the basis of stage of lactation as early lactation (14-100 days), mid lactation (100-200 days), late lactation (200-360 days). About 88 milk samples were coming under early lactation stage, 120 samples under mid lactation and 66 samples under late lactation. Percentage of cow milk samples under different stages of lactation is given in the Fig. 1.
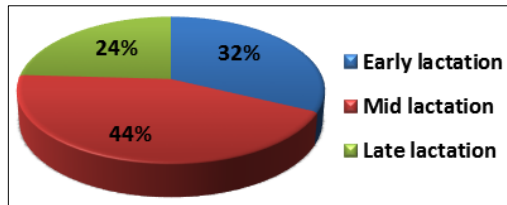

Fig 1: Percentage of milk samples coming under each classes of stage of lactation

All the milk samples were subjected to estimation of total solids, fat, protein and lactose content. The overall mean value for each milk constituents is given in the Table 1.

Table 1: Overall mean of the different milk constituents

S. No.	Milk constituents	Mean ± SD
1	Fat	4.2 ± 1.411
2	Protein	3.02 ± 0.226
3	Lactose	4.52 ± 0.251
4	Total solids	12.46 ± 1.411
5	SNF	8.25 ± 1.339

The mean of different milk constituents in each category of stage of lactation were given in the Table 2.

Table 2: Mean of different milk constituents in each category of stage of lactation

Milk constituents	Early lactation	Mid lactation	Late lactation
Fat	3.72±0.319	4.6±0.287	4.55±0.352
Protein	3.04 ± 0.258	2.98 ± 0.236	2.99 ± 0.230
Lactose	4.57 ± 0.235	4.56 ± 0.254	5.09 ± 0.290
Total solids	11.45 ± 0.336[a]	12.4 ± 0.302	12.32 ± 0.371
SNF	8.32 ± 0.440	8.33 ± 0.44	8.17 ± 0.447

The data were subjected to one way ANOVA for analyzing impact of stage of lactation, on protein per cent, lactose per cent, fat per cent, total solids content and SNF per cent. The stage of lactation had a significant impact on fat per cent and total solids content (P<0.05) in case of milk samples with SNF < 8.3 per cent. Stage of lactation was insignificant on protein, lactose and SNF percentage. For milk samples with SNF >8.3 per cent stage of lactation had no significant influence on any of the milk constituents.

The mean fat percentage and total solids percentage on each category of stage of lactation in ANOVA analysis is given in Table 3.

Table 3: The mean value of fat and protein for different category of stage of lactation (ANOVA results)

Stage of lactation	Mean fat per cent	Mean total solids percentage
Early lactation	3.720 ± 0.319[a]	11.451 ± 0.336[a]
Mid lactation	4.603 ± 0.287[b]	12.401 ± 0.302[b]
Late lactation	4.557 ± 0.352[b]	12.324 ± 0.371[b]

A study conducted at Gondar University at Ethiopia showed that the effect stage of lactation on milk fat was significant (Gurmessa and Melaku, 2012) [4]. Sourabh *et al*., (2016) [7] reported that impact of stage of lactation was highly significant (P<0.01) on fat percentage and total solids. El Zubeir *et al*., (2016) [3] were also had a similar observation. All these results are agreed with our findings. Following reports do not support our findings. Sarkar *et al*., (2006) [5] reported that lactation stage had no influence on fat content but a significant effect on protein, SNF and lactose content. Boro *et al*., (2016) [1] found that the influence of stage of lactation is significant on protein, SNF and lactose percentage but not for fat percentage. The study was conducted with indigenous breeds of India especially Tharparkar and results were not compatible with our results.

4. Conclusion
The stage of lactation had a significant impact on fat per cent and total solids content. The mean value of fat in each category of stage of lactation was 3.720 ± 0.319, 4.603 ± 0.28, 4.557 ± 0.352 respectively. The mean value of total solids in each category of stage of lactation was 11.451 ± 0.336, 12.401 ± 0.302, 12.324 ± 0.371 respectively. The fat percentage of the cow milk was comparatively lower in early stage of lactation. The lactose percentage was also higher in late stage of lactation.

5. References
1. Boro P, Naha BC, Prakash C, Madkar A, Kumar N, Kumari A *et al*. Genetic and non-genetic factors affecting milk composition in dairy cows. International Journal of Advanced Biological Reasearch. 2016; 6:170-174.
2. Bureau of Indian Standards. SP: 18. Hand book of food analysis - Part XI. Dairy products. Bureau of Indian Standards. Manak Bhavan, 9, Bahadur Shah Zafar Marg, New Delhi, 1981, 1-66.
3. El Zubeir IE, Shuiep ES. Effect of Stage of Lactation and order of Parity on Milk Composition and Daily Milk Yield among Local and Crossbred Cows in South Darfur State, Sudan. Journal of Science and Technology. 2016; 17(2).
4. Gurmessa J, Melaku A. Effect of Lactation Stage, Pregnancy, Parity and Age on Yield and Major Components of Raw Milk in Bred Cross Holstein Friesian Cows. World Journal of Dairy and Food Sciences. 2012; 7:146-149.
5. Sarkar U, Gupta AK, Sarkar V, Mohanty TK, Raina VS, Prasad S. Factors affecting test day milk yield and milk composition in dairy animals. Journal of Dairying, Foods and Home Sciences. 2006; 25:129-132.
6. Snedecor GW, Cochran WG. Statistical methods. (8th Ed.). Oxford and IBH Publishing Company, Culcutta, 1994, 564p.
7. Sourabh Y, Shankar SS, Kumar CS, Om P, Shweta J. Effect of season, lactation and parity on yield and major components of raw milk in cross bred holstein friesian cows. International Journal of Agricultural Sciences. 2016; 62:3536-3539.