

## **LOW SOLIDS NOT FAT PERCENTAGE IN MILK OF CROSSBRED COWS IN WAYANAD DISTRICT OF KERALA, INDIA – A RETROSPECTIVE STUDY**

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**Abstract:** Fat and solids not fat contents of milk decide the milk price and consumer acceptance of cow milk and hence a scientific study on major constituents of milk was conducted in the hilly district of Wayanad, Kerala state, India, in 2007. Then prevailing Prevention of Food Adulteration (PFA) Act standards for cow milk in Kerala state were 3.5 and 8.5 percent for milk fat and Solids Not Fat (SNF), respectively. 268 Cows from five centres of Wayanad were selected and 929 morning and evening milk samples were analyzed for fat and SNF in different stages of lactation. The overall least squares mean for milk fat and SNF were  $3.515 \pm 0.080$  and  $8.359 \pm 0.042$  respectively. 47.3 per cent of cows in early stage of lactation were found to have morning milk fat below the then prevailing PFA Act standards in Kerala state. As far as SNF percentage is concerned, considering all the stages of lactation together, 60.1 per cent in morning milk and 77.6 per cent of cows in evening milking had percentage below the then prescribed legal standards of 8.5 percent. Crossbred cows of Wayanad have more of Holstein Friesian inheritance which might be a genetic reason towards low level of milk fat percentage in morning milk samples of early lactation cows. Other non-genetic factors for low fat and SNF include sub clinical mastitis and anemia due to incidence of hemoparasites, which is quite high in Wayanad due to its proximity to forest areas. Food Safety and Standard Authorities of India (FSSAI) has modified the present legal standards of SNF and fat in cow milk all over the country as 8.3 and 3.2 percentage respectively from 2017 onwards, which is quite consoling, not only to Wayanad cattle farmers, but farmers all over the state and will probably act as an encouraging factor for more production of cow milk in the state.

**Keywords:** Milk fat, solids not fat, crossbred cows, Wayanad district, new FSSAI standards.

### **Introduction**

The pricing system for cow milk in milk societies of Kerala is based on the percentages of milk fat and Solids Not Fat (SNF). Thus, milk constituents like fat and SNF not only determines consumer's receptivity of milk, but also decides the milk price. Prevention of Food Adulteration Act has fixed the minimum fat percentage as 3.5 and SNF percentage as 8.5 for Kerala state, India and this rate existed in the state till 2017. Milk with less than 3.5% fat and/or 8.5% SNF used to fetch lesser price to the farmer. Widespread complaints persisted

among farmers of the state regarding low fat and SNF for their crossbred dairy cattle and scientific literature also supported the fact that fat and SNF are not meeting the high existing standards, at least during certain stages of lactation. Instances, where allegation of adulteration of milk creating problems to the farmer, have also been not rare. Hence a detailed study was conducted to probe into the milk fat and SNF percentages of crossbred cows in Wayanad district of Kerala. Wayanad district located 700 – 2100 m above mean sea level, on the north-east of Kerala, is the second largest milk producing district in the state, with a production of 4,00,25,322 litres in 2004-05 (Karshakasree, 2005). When compared to other districts in Kerala, Wayanad has more congenial climate and fodder availability for cattle rearing and hence the investigators intended to analyse whether the complaint of low milk fat and SNF in cow milk, existed in Wayanad also.

### **Materials and Methods**

The study was conducted in the northern hilly district of Wayanad, which seriously lacks scientific data on milk yield and constituents. Geographic terrain of Wayanad district with plain lands and steep hilly areas demanded selection of Crossbred Cows from five different centres namely - Ambalavayal, SulthanBathery, Meenangadi, Vythiri and Veterinary College Livestock Farm, Pookode. 268 cows which calved from April to July 2007 were selected. A total number of 929 milk samples from 244 cows were collected in morning and evening during early, middle and late lactation and were analyzed for fat, solids not fat and total solids. Milk fat was estimated using electronic Milk Fat Tester and the equipment was calibrated with Gerber's method. SNF was estimated using lactometer with frequent calibration with gravimetric method for total solids estimation. Least squares means were calculated after nullifying the effects of centre, season and parity using SPAB – 2 package (Sethi 2002). The model used was,

$$Y_{ijkl} = \mu + C_i + S_j + P_k + e_{ijkl}$$

Where,  $Y_{ijkl}$  =  $l^{\text{th}}$  observation of  $k^{\text{th}}$  parity of  $j^{\text{th}}$  season of  $i^{\text{th}}$  centre;  $\mu$  = overall mean;  $C_i$  = effect of  $i^{\text{th}}$  centre;  $S_j$  = effect of  $j^{\text{th}}$  season;  $P_k$  = effect of  $k^{\text{th}}$  parity and  $e_{ijkl}$  = random error.

### **Results and Discussion**

Prevention of Food Adulteration Act has set up the minimum standards of milk fat and SNF percentages as 3.5 and 8.5 percentages in Kerala and it existed so till 2017. Since the pricing of milk in milk societies is based on fat and SNF, any value beneath the prescribed standards used to fetch less price to the milk sold and hence it was a matter of serious concern to the farmers. 47.3 per cent of cows in early stage of lactation had morning

milk fat below 3.5 percent, whereas in the case of evening milk samples 11.8 per cent of cows in early lactation were below the standards. After pooling the data, when all stages of lactation were considered, cows with milk fat percentage below the then prescribed PFA standards were less in Wayanad when compared to Thrissur (Radhika, 1997). This may be attributed to the fact that lush green pasture lands are more in Wayanad when compared to Thrissur, increasing the availability of green fodder to grazing animals. The least squares analysis of variance revealed that the mean milk fat percentage was  $3.515 \pm 0.080$  (Table – 1). Centre had significant effect on milk fat percentage ( $p < 0.05$ ), whereas parity and season of calving had no significant effect on milk fat per cent. This pointed to the fact that even though morning milk samples of early lactation showed less than the then existing legal standards of fat percentage, overall fat percentage was above the then prescribed minimum of 3.5 percent in crossbred cows of Wayanad.

The overall average for SNF percentage was  $8.359 \pm 0.042$  (Table 1), which was below the then prescribed PFA standards of 8.5 percent. This was a matter of great concern because farmers are being accused of adulterating the milk which they sell and hence given a lesser price for lowered SNF. Actually, cows are producing milk with SNF below the then existing legal standards. The least squares analysis of variance revealed that centre had very significant effect on SNF and total solids percentage ( $p < 0.01$ ) whereas parity and season of calving had no significant effect on these parameters. In the beginning of lactation, during early period (first 100 days), 44.2 per cent of cows had morning milk SNF below 8.5 %. It was interesting to note that as the lactation advanced, naturally the fat percentage also increased, and then the solids not fat kept on decreasing alarmingly. During middle and late lactation morning milk samples, 57.5 and 82.7 per cent of cows respectively had less than 8.5% SNF (Fig.-1). In the case of evening milk samples 82.8 per cent of cows in early lactation, 61.9 per cent in middle lactation and 92.5 per cent in late lactation had less than the then minimum standards of 8.5 per cent SNF (Fig. -2). Considering all the stages of lactation together, 60.1 per cent in morning milk and 77.6 per cent of cows in evening milking had milk SNF percentage below the then prescribed PFA standards. This was much higher than the figures obtained in a similar study conducted in crossbred cows at Thrissur, where 47% of cows, irrespective of lactation stage and time of milking, recorded an SNF percentage below 8.5. (Radhika *et al.*, 1999). According to Sebastian and Geevarghese (1995) there is a possibility of obtaining milk with fat and SNF below minimum standards prescribed in PFA Act for many states in India. Malabar Regional Co-operative Milk Producer's Union Ltd.,

Kozhikode (MRCMPU) (1995) reported 73.8 per cent animals with milk SNF below legal standards. The results of the present study showed that low milk fat in early lactation and low SNF in almost all stages of lactation existed among cows of Wayanad district, Kerala

**Factors affecting fat and solids not fat-** Milk composition varies considerably among breeds of dairy cattle with Jersey and Guernsey breeds yielding milk of higher fat and protein content than Holstein Friesian cows. Indigenous cows yield less amount of milk containing high fat percentage. But Kerala, at present has a crossbred cattle population with mosaic inheritance from, Jersey, Brown Swiss and Holstein Friesian along with genes from indigenous cattle. Wayanad district has congenial climate and relatively low ambient temperature which favours rearing of high milk producing cattle and hence Holstein Friesian is the preferred breed. Major genetic factor leading to a decline in milk fat percentage must be the increased inheritance of Holstein Friesian among crossbred cows of Wayanad. Genetic variability between animals is also a factor which has to be taken into consideration. Though heredity determines milk production and composition, environment and various physiological factors greatly influence the quantity and quality of milk that is actually produced. One of the major non-genetic factors that have been reported to affect fat and SNF in milk production is nutrition. Harris and Beckman (1988), reported that when extra energy was fed to high producing cows, SNF increased by about 0.2 percentage units. Cows in Wayanad are high yielding animals and the low level of SNF might be an indication towards insufficient energy intake. Addition of whole cottonseed or added fat to dairy cattle rations may also reduce the SNF content of milk. Forage quality and quantity also affects milk SNF. Good quality hay tends to increase SNF, but poor-quality hay may reduce both intake and SNF. Effect of centre on fat and SNF points to the fact that different feeding patterns existing in different areas, influenced the level of fat and SNF in milk. Alfonso-Avila *et al* (2011) reported that Multiple regression analysis showed no significant ( $P > 0.05$ ) model relating intake of feed groups and milk fat content, but milk protein and SNF contents were significantly explained by intake of High Crude Protein in the feed stuff. Supplementation of protected nutrients to buffaloes increased milk production and unsaturated fatty acids content in milk fat, and persistence of lactation, after supplements were withdrawn (Shelke *et al*, 2012).

Another major reason for decline in SNF, protein, and lactose content is associated with sub clinical and clinical mastitis. Incidence of mastitis among crossbred cows in Kerala is quite high. As per 2006 disease surveillance report by the Kerala Government, the annual

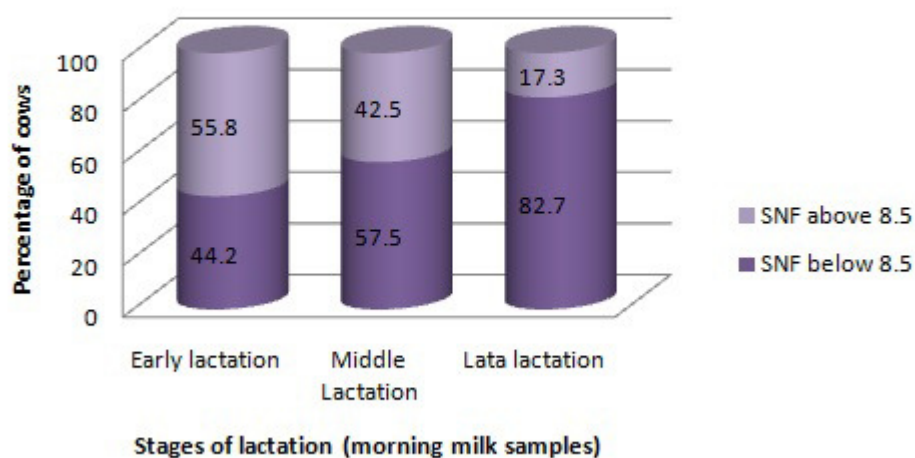
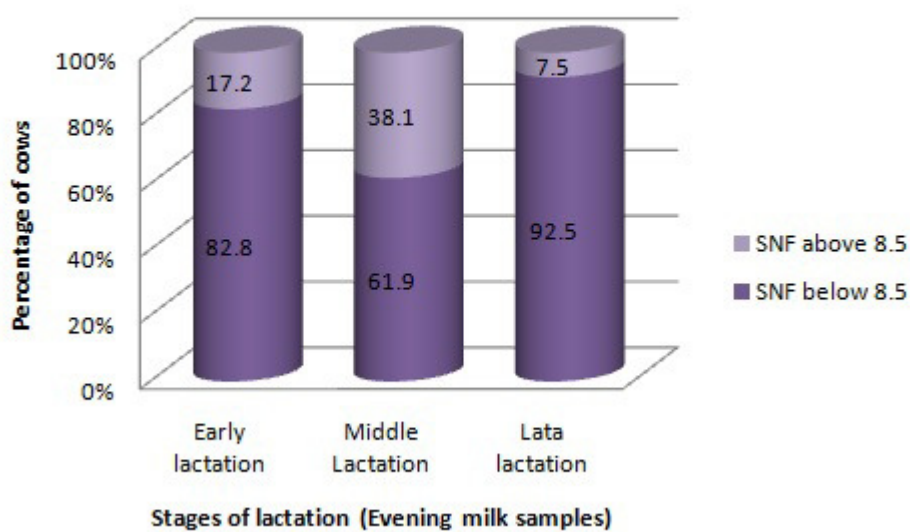
economic loss due to mastitis is estimated to be 36.54 crores in cattle. Batavani *et al.* (2007) reported that protein fractions were significantly different in normal and subclinical mastitis milk. Ogole (2007) also reported that clinical and subclinical mastitis produced significant changes in composition of milk. Anemia is another reason for decline in SNF and since incidence of hemoparasites is quite high in Wayanad due to its proximity to forest areas; this could be a major reason. Perry and Randolph (1999) reported great economic losses in productivity of dairy cattle due to parasitism.

SNF content of milk decreases with age of the cow. Within any given lactation, SNF content is relatively high the first month, drops to a low the second, then rises as lactation progresses. As far as this study is concerned, SNF was low throughout, irrespective of stage of lactation and during the later stages of lactation when fat percentage increased; there was considerable reduction in SNF. Mech (2008) also reported that SNF did not vary with different stages of lactation. But in another study in Northern India by Jadhav and Patange (2009) on newly evolved genotype namely "Phule triveni" revealed that fat, total solids and SNF, being significantly ( $P < 0.05$ ) affected by the stage of lactation. Least squares analysis for milk SNF percentage revealed that the effect of centre was highly significant, whereas parity and season had no significant effect on SNF percentage. Topographical peculiarities and difference in feed ingredients must have resulted in such a significant difference between centres. Some of the farmers in Wayanad, procure raw materials from neighboring states like Tamil Nadu and prepare concentrate feed of their own to feed their cow. A proximate analysis of these feeds will reveal imbalances if any, which should be corrected.

Though crossbred cattle of Wayanad are performing comparatively well in terms of milk production, there is a reduction in fat and SNF content of milk due to genetic and non-genetic reasons mentioned above. An insight into these factors and a purposeful effort to rectify the defects, wherever possible, might improve the situation. Since pricing of milk is based on fat and SNF content and since low fat and SNF can occur due to scientific factors mentioned above, a corrective measure was the need of the hour for sustainable dairy farming in the state. As a boon to the farmers, FSSAI (2017), reduced the prescribed levels of cow milk fat and SNF in all states of India, as 3.2 and 8.3 percentage respectively, which will act as a marginal encouragement to dairy farmers of the state. Now the efforts of farmers will be to retain the milk fat and SNF percentages at a minimum level of 3.2 and 8.3 percentages respectively in all stages of lactation, which will be a more practical solution as far as crossbred cows are concerned.

**Table 1: Least Squares Means of Fat and Solids Not Fat (SNF)**

	Fat percentage	SNF percentage
Mean±SE	3.515 ± 0.080	8.359 ± 0.042

**Fig1 - Percentage of cows with SNF below 8.5% in morning milk samples****Fig 2 - Percentage of cows with SNF below 8.5% in evening milk samples**

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