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Maheshwari S

PG Scholar, Post Graduate
Research Institute in Animal
Sciences, Tamil Nadu Veterinary
and Animal Sciences University,
Kattupakkam, Tamil Nadu,
India

S Jaishankar

Associate Professor, Post
Graduate Research Institute in
Animal Sciences, Tamil Nadu
Veterinary and Animal Sciences
University, Kattupakkam, Tamil
Nadu, India

Corresponding Author:

Maheshwari S

PG Scholar, Post Graduate
Research Institute in Animal
Sciences, Tamil Nadu Veterinary
and Animal Sciences University,
Kattupakkam, Tamil Nadu,
India

A study on variation in milk composition of cross bred cows during different stages of lactation

Maheshwari S and S Jaishankar

Abstract

A study was conducted to assess the influence of stage of lactation on milk composition of Jersey X Red Sindhi crossbred cows maintained at Post Graduate Research Institute in Animal Sciences, Kattupakkam. A total of 720 milk samples were collected at weekly interval from December 2015 to May 2016. The study animals were classified according to stage of lactation. The milk composition viz., fat, solid not fat, total solid, protein and lactose content of milk were analyzed. All parameters of milk except lactose, showed highly significant ($p < 0.01$) difference between stage of lactation.

Keywords: Milk composition, fat, SNF, Protein, lactation stage

Introduction

Milk is a heterogeneous colloidal product in which fat and protein are dispersed in water and other substances like sugars and minerals are held in solution form. Milk and milk products are important component of human diet. In general, the composition of milk varies with season, stage of lactation, parity, feeding, health status of the animal, milking interval, genetic factors and other day to day variation (Auld et al., 1998; Radhika and Iype, 1999; Bernabuccai et al. 2002; Lindmark-Mansson et al., 2003; Sarkar et al., 2006; Heck et al., 2009 and Sudhakar et al., 2013) [1, 12, 2, 10, 13, 4, 15]. The composition of milk is of greater importance for dairy industry and the composition of raw milk determines the nutritive value and technological properties of milk and milk products. Knowing the composition of milk also helps to assess the adulteration and quality of the milk for consumers and milk processing industries. Moreover, the price of milk and consumer's interest varies with milk components especially fat and solid not fat (SNF), which may directly affect the farm income. Hence, this study was undertaken to determine the influence of different stage of lactation on composition of Jersey X Red Sindhi crossbred cow's milk.

Materials and Method

Thirty Jersey X Red Sindhi crossbred milch cows available at Post Graduate Research Institute in Animal Sciences, Kattupakkam were selected for this study. The crossbred cows were maintained under semi-intensive system of management under uniform feeding regime throughout the study period. The study animals were classified according to stage of lactation. The information about the stage of lactation were obtained from the record available in the Cattle and Buffalo Breeding Unit of the same farm. The cows between 5 and 90 days of parturition were classified as early, those between 91 and 180 days as mid and those above 180 days of lactation as late stage of lactation (Sudhakar et al., 2013 and Kayastha et al., 2008) [15, 8]. Fat was estimated by Gerber's method (ISI, 1977) [6], solid not fat by lactometer method (ISI, 1982) [5] protein by formaldehyde titration method (Pyne, 1932) [11] and lactose by Benedict's quantitative method (Sharma, 2007) [14]. The total solid percentage was determined by adding fat and solid not fat percentage of milk (Sarkar et al. 2006) [13]. The data collected were analysed by general linear model (GLM) using SPSS IBM 20.

Results and Discussion

The Mean \pm S.E of milk composition of Jersey X Red Sindhi cow during different stages of lactation are presented in Table 1.

Table 1: Effect of stage of lactation on milk composition in Jersey X Red Sindhi crossbred cows

Components	Early stage (5 to 90 days)	Mid stage (90 to 180 days)	Late stage (>180 days)	p value
Fat (%) **	3.93 ^a ± 0.05	4.39 ^b ± 0.04	4.71 ^c ± 0.03	0.000
SNF (%) **	8.73 ^a ± 0.03	8.65 ^a ± 0.02	8.56 ^b ± 0.02	0.000
Total solids (%) **	12.66 ^a ± 0.06	13.04 ^b ± 0.05	13.27 ^c ± 0.04	0.000
Protein (%) **	3.34 ^a ± 0.01	3.31 ^b ± 0.01	3.28 ^c ± 0.01	0.000
Lactose (%) ^{NS}	4.62 ± 0.01	4.61 ± 0.01	4.60 ± 0.01	0.154

** - Means bearing different superscript within a row differ significantly ($p < 0.01$)

^{NS} - Not significant

Fat

The mean fat percentage of crossbred cows during early, mid and late lactation were 3.93 ± 0.05, 4.39 ± 0.04 and 4.71 ± 0.03, respectively presented in Table 1. The significantly ($p < 0.000$) highest fat percentage was observed in late stage of lactation followed by mid and early stages.

The present results are in accordance with the findings of Kumaresan, (2013) ^[9], Yadav *et al.* (2013) ^[16], Gurmessa and Melaku (2012) ^[3], Jadhav and Patange, (2009) ^[7] also stated significantly ($p < 0.05$) increased milk fat with advanced stage of lactation and significantly highest fat percentage was observed during later stage of lactation.

Solid Not Fat

The mean SNF percentage of crossbred cows during early, mid and late lactation were 8.73 ± 0.03, 8.65 ± 0.02 and 8.56 ± 0.02, respectively presented Table 1. There was no statistical difference found between first and second stage of lactation, however higher level of solid not fat content was observed in early stage than mid stage of lactation. Kumaresan, (2013) ^[9] also stated significantly ($p < 0.05$) lower level of solid not fat content during later stage of lactation.

Total solid

The mean total solid percentage of crossbred cows during early, mid and late lactation were 12.66 ± 0.06, 13.04 ± 0.05 and 13.27 ± 0.04, respectively (Table 1). The total solid content in late stage was significantly highest over the remaining stages of lactation. Jadhav and Patange, (2009) ^[7] also stated that total solid was significantly ($p < 0.05$) increased with advanced stage of lactation and significantly highest fat percentage was observed during later stage of lactation. These findings were similar to the results of the present findings.

Protein

The mean protein percentage of crossbred cows during early, mid and late lactation were 3.34 ± 0.01, 3.31 ± 0.01 and 3.28 ± 0.01, respectively (Table 1). The highest protein percentage was observed in early stage of lactation followed by mid and late stages of lactation. In accordance with present findings, Yadav *et al.* (2013) ^[16] reported that the decreased milk protein content with advanced stage of lactation.

Lactose

The mean lactose content of crossbred cows during early, mid and late lactation were 4.62 ± 0.01, 4.61 ± 0.01 and 4.60 ± 0.01, respectively (Table 1). The lactose content of milk did not show statistical significant ($p > 0.05$) difference between the stages of lactation. However, the non-significantly higher level of lactose content was observed in early stage of lactation followed by mid and late stages of lactation.

Gurmessa and Melaku (2012) ^[3], Sarkar *et al.*, (2006) ^[13] and Sudhakar *et al.* (2013) ^[15] reported the same non-significant effect stage of lactation on lactose content of milk.

Conclusion

From the above findings it can be concluded that stage of lactation had significant influence on milk composition. The highest fat and total solid percentage were recorded during late stage of lactation followed by mid and early stage of lactation. On contrary to this, protein and solid not fat content of milk decreased towards the end of the lactation. The highest protein and solid not fat content was observed during early stage of lactation followed by mid and late stage of lactation. Although the stage of lactation had significant influence on milk fat, protein, solid not fat and total solid content of milk, the lactose content of milk had no significant influence by stage of lactation. This might be due to close relation between lactose synthesis and amount of water drawn into milk makes lactose content as a stable component (Pollot, 2004).

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