



# Chemical quality of raw milk as influenced by stages of lactation of crossbred cows

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**ABSTRACT :** A study was conducted at Chitrakoot–Satna (M.P.) and Smriti Products (Pvt.) Ltd., Saha, Ambala (Haryana), during April to June 2014 to determine the chemical quality of raw milk as influenced by stages of lactation of crossbred cows. The objective was to evaluate the compositional quality of raw milk of different crossbred cows. Ten healthy cows, free from any disease, and maintained under similar management conditions, were selected for the study. All sanitary precautions were undertaken to produce clean milk. The samples of raw milk collected from time to time, were tested to determine total solid ( % ), fat ( % ), solid not fat ( % ), protein ( % ), lactose ( % ), ash ( % ), specific gravity (cc), and water ( % ). The data obtained for the aforesaid tests were subjected to statistical analysis. The results of the statistical analysis showed that the differences in TS, fat, SNF, protein, lactose, ash and water of raw milk were non-significant and the results of F-test were also found non-significant due to stages of lactation. Only specific gravity was significant. Therefore, the chemical quality of raw milk of crossbred cows was not influenced by stages of lactation. The results further indicated that compositional quality of raw milk of third lactation stage ( $S_3$ ) was best followed by second ( $S_2$ ) and first ( $S_1$ ) stages of lactation.

**KEY WORDS :** Raw milk, Chemical quality, Stages of lactation, Crossbred cows

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## INTRODUCTION

Milk is a highly nutritious food, ideal for microbial growth. Fresh milk easily deteriorates to become unsuitable for processing and human consumption FAO (2001). According to Ramesh (2006), the major components of milk are water (87.4%), milk solids (12.60%), solids-not-fat (9.0%), fat (3.60%), protein (3.40%), milk sugar or lactose (4.90%) and ash or minerals (0.70%). Milk is also an important vehicle for transmission of pathogenic microorganisms to human beings unless it is produced and handled under good hygienic conditions.

Quality milk means, the milk which is free from pathogenic bacteria and harmful toxic substances, free from sediment and extraneous substances, of good flavour, with normal composition, adequate in keeping quality and low in bacterial counts Khan *et al.* (2008).

The livestock sector consisting of animal husbandry and dairying activities plays a vital role in India's agricultural economy, contributing about 31 per cent of the GDP of agriculture and allied sectors and offers opportunity of earnings foreign exchange worth Rs. 163716 crore annually by export of bones, hides, hairs, etc. Livestock contributes 7 per cent to national income and milk output account for 5.6 per cent to GNP. Livestock industry offers income round the year and contributes about 8 per cent to GDP of India (Prasad, 2013). It contributes to the food and nutrition security, as also to the livelihood of the farmers and is registering higher growth compared to other sub-sectors of agriculture (National Livestock Policy, 2013). Most of the livestock producers being small and marginal, farmers, their capacity to mobilise resources required to absorb the latest technologies developed by

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research institutions are limited. Contribution of livestock is high but investment in animal husbandry and dairy development is very low, *i.e.* less than 10 per cent of investment in agriculture sector (Prasad, 2013).

Milk is nature's ideal food for newly born and the young ones but because of possibility of it being a source of chemical hazards, it cannot be considered totally safe if not produced and handled under sanitary condition. Production of quality milk with better compositional attributes is of utmost importance with longer keeping quality and to make good quality dairy products. Chemical quality of milk constituents is indicative of the nutritional value of the milk, and provides a basis of determining its richness, health-fullness and other useful purposes, which are of utmost significance from the consumer's point of view. It is encouraging to note that annual milk production in India has grown to an anticipated level of 140.6 million tonnes in 2014, and per capita milk availability has reached to a level of 290 g./day. Repost in PTI OCT 22, 2013, 04.28 PM IST as Compared to amount of 132 g/Capita/days in 1951 (Makwana *et al.*, 2011).

It is encouraging that the concept of clean milk production has recently gained momentum due to fast deterioration of quality from producer to dairy dock and needs to preserve quality of milk for better quality milk products. This has also been necessitated by the fact that foreign products are entering into Indian markets due to liberalization of economy with a claim that they have been produced from better quality raw milk. It has become imperative for Indian dairy industry to produce clean raw milk for safe and quality milk and milk products to compete in national and international market in the WTO era.

Supply of dairy products have to be addressed as part of any debate on food security several measures need to be adopted in order to successfully meet the challenges in keeping in quality of raw milk.

### MATERIAL AND METHODS

The study was conducted in the Department of N. R. M., Faculty of Agriculture, Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot-Satna (M.P.), and Smriti Products (Pvt.) Ltd., Saha, Ambala (Haryana) during April to June 2014 to study the chemical quality of raw milk as influenced by stages of lactation of crossbred cows. Stages of lactation as indicate by S will be divided into three stages *i.e.* S<sub>1</sub>, S<sub>2</sub>, S<sub>3</sub> in which S<sub>1</sub> (upto 100 days) of lactation, S<sub>2</sub> (101 to 200 days) of lactation and S<sub>3</sub> (201 to 300 days) of lactation.

S <sub>1</sub> (Up to 100 days)	S <sub>2</sub> (101 – 200 days)	S <sub>3</sub> (201 – 300 days)
601,603,607	606,608,610	602,604,605,609

All sanitary precautions were followed to produce clean milk. The samples of raw milk were collected for ten days.

Samples were collected from the milking pail separately in sterile 250 ml conical flasks and plugged aseptically with cotton plug. The samples were then brought immediately to the laboratory for determination of total solid (%), fat (%), solid not fat (%), protein (%), lactose (%), ash (%), specific gravity (cc), and water (%) as per the procedure and norms set by AOAC (2000). The data obtained for the aforesaid tests were subjected to statistical analysis.

### RESULTS AND DISCUSSION

In general, total solid percentage in raw milk ranged from 11.82 to 15.40. T. S. percentage in raw milk in S<sub>1</sub>, S<sub>2</sub> and S<sub>3</sub> stage of lactation ranged from 11.89 to 15.40, 11.82 to 14.10 and 12.16 to 14.87, respectively with mean of 13.08, 13.39 and 13.57, respectively. The differences in the T.S. in raw milk were non-significant.

Fat percentage in raw milk ranged from 2.80 to 4.70. percentage of fat in raw milk in S<sub>1</sub>, S<sub>2</sub> and S<sub>3</sub> stages of lactation ranged from 2.80 to 4.70, 3.20 to 4.10 and 3.60 to 4.40, respectively, with mean of 3.60, 3.70 and 3.90 per cent, respectively. The differences in the fat in raw milk were non-significant.

S.N.F. in raw milk ranged from 7.76 to 12.30 per cent. S.N.F. of raw milk in lactation stages S<sub>1</sub>, S<sub>2</sub> and S<sub>3</sub> ranged from 8.19 to 12.30, 8.62 to 10.50 and 7.76 to 10.77 per cent, respectively, with mean of 9.42, 9.56 and 9.56 per cent. The differences in the S.N.F. in raw milk were non-significant.

Protein percentage in raw milk of crossbred cows ranged from 3.23 to 4.05. Protein percentage of raw milk in S<sub>1</sub>, S<sub>2</sub> and S<sub>3</sub> ranged from 3.23 to 3.85, 3.26 to 4.01 and 3.52 to 4.05, respectively. Mean protein per cent of raw milk in S<sub>1</sub>, S<sub>2</sub> and S<sub>3</sub> was 3.51, 3.56 and 3.77 per cent, respectively. The differences in the protein in raw milk were non-significant.

Lactose percentage in raw milk of crossbred cows ranged from 4.30 to 4.90. Per cent lactose of raw milk in lactation stages S<sub>1</sub>, S<sub>2</sub> and S<sub>3</sub> ranged from 4.30 to 4.70, 4.30 to 4.80 and 4.50 to 4.90, respectively. Mean per cent lactose of raw milk in S<sub>1</sub>, S<sub>2</sub> and S<sub>3</sub> was 4.43, 4.58 and 4.71, respectively. The differences in the lactose in raw milk were non-significant.

Ash percentage in raw milk ranged from 0.61 to 0.71. Per cent ash in raw milk in S<sub>1</sub>, S<sub>2</sub> and S<sub>3</sub> ranged from 0.61 to 0.70, 0.61 to 0.69 and 0.61 to 0.71, respectively, with mean of 0.64, 0.66 and 0.67 per cent, respectively. The differences in the ash in raw milk were non-significant.

Specific gravity in raw milk of crossbreed cows ranged from 1.024 to 1.032 cc. Specific gravity of raw milk in S<sub>1</sub>, S<sub>2</sub> and S<sub>3</sub> ranged from 1.026 to 1.030, 1.024 to 1.030 and 1.028 to 1.032 cc, respectively, with mean of 1.028, 1.029 and 1.030 cc, respectively. The differences in the specific gravity in raw milk were significant.

Water percentage in raw milk ranged from 84.60 to 88.18. Per cent water in raw milk of S<sub>1</sub>, S<sub>2</sub> and S<sub>3</sub> ranged from 84.60 to

**Table 1 : Chemical composition of raw milk of crossbred cows**

Composition	Stages of lactation			Result
	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	
Total solid (TS)	13.08	13.39	13.57	Non-significant
Fat (%)	3.60	3.70	3.90	Non-significant
Solid not fat (%)	9.42	9.56	9.56	Non-significant
Protein (%)	3.51	3.56	3.77	Non-significant
Lactose (%)	4.53	4.58	4.71	Non-significant
Ash (%)	0.64	0.66	0.67	Non-significant
Specific gravity (cc)	1.028	1.029	1.030	Significant
Water (%)	86.91	86.60	86.42	Non-significant

**Table 2 : Mean value of parameters (%)**

Mean value	Stage of lactation		
	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>
Total solid (T.S)	13.08	13.39	13.57
Fat	3.6	3.7	3.9
Solids not fat (S.N.F)	9.42	9.56	9.56
Protein	3.51	3.56	3.77
Lactose	4.53	4.58	4.71
Ash	0.69	0.66	0.67
Specific gravity (Sp.Gr.)	1.028	1.029	1.030
Water	86.91	86.6	86.42

Rating of milk quality based on chemical parameters S<sub>1</sub>>S<sub>2</sub>>S<sub>3</sub>

88.11, 85.90 to 88.18 and 85.13 to 87.84, respectively with mean of 86.91, 86.60 and 86.42 per cent, respectively. The differences in the water in raw milk were non-significant. Similar work related to the present investigation was also carried out by Bell *et al.* (1995) and Khan *et al.* (2011).

**Conclusion :**

On the basis of the results obtained, it was concluded that the chemical quality of raw milk of crossbred cows was not influenced by stages of lactation. The results further indicated that compositional quality of raw milk of third lactation stage (S<sub>3</sub>) was best in terms of maximum percentage of total solid, fat, solid not fat, protein, lactose, ash and specific gravity (cc) and minimum water percentage; followed by second (S<sub>2</sub>) and first (S<sub>1</sub>) stages of lactation.

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