The Pharma Innovation Journal 2023; SP-12(8): 914-917

www.ThePharmaJournal.com

The Pharma Innovation

**ISSN (E): 2277-7695**
**ISSN (P): 2349-8242**
**NAAS Rating: 5.23**
TPI 2023; SP-12(8): 914-917

www.thepharmajournal.com
Received: 25-05-2023
Accepted: 28-06-2023

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# Comparative analysis of milk composition of Sahiwal and crossbred cattle under farm condition

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**Abstract**
The present study was undertaken to analyze and compare the milk composition of Sahiwal and crossbred cattle under farm condition. Milk composition parameters were estimated for 48 (24 Sahiwal and 24 crossbred) dairy cattle. The relationship between milk compositional parameters was also investigated. The results of the study indicated that fat ($p$<0.001), SNF ($p$<0.05), and total solid % ($p$<0.001) were significantly higher in Sahiwal as compared to crossbred cattle milk. Milk composition parameters were significantly ($p$<0.05) affected by lactation. Fat, SNF, protein, lactose, and total solids (TS) % showed a decreasing ($p$<0.05) trend from 1st lactation to 4th lactation with highest mean values is 1st lactation in Sahiwal milk. Milk composition did not show significant changes in different lactation of crossbred cattle except fat% While determining the correlation, fat showed highly significant ($p$<0.01) correlation with SNF, protein, TS and lactose ($p$<0.05) in both Sahiwal and crossbred dairy cattle. There was significant ($p$<0.05, $p$<0.01) positive correlation of SNF with protein, lactose and TS. TS had highly significant ($p$<0.01) positive correlation with protein and lactose in both the groups. The milk composition was found to change significantly with breed and lactation.

**Keywords:** Crossbred, fat, lactose, milk, protein, Sahiwal, total solid

## 1. Introduction
The composition of milk is an important performance trait. Components such as fat, protein, lactose and SNF are measured to assess milk quality. Various genetic and environmental factors, including parity, breed, lactation stage, and agro-climatic conditions, have been found to affect milk composition (Radhika and Iype, 1999; Sarkar *et al.*, 2006) [12, 14]. High levels of fat and protein are desirable for dairy cows as they contribute to milk solid content and overall milk value. Comparative milk composition of native cattle and widely utilised breeds around the world, including their crossbreds, has been described in several studies. The milk composition of cows with advanced methods of management has also been profiled because milk is believed to be a natural food with nutritional and health benefits and is obtained without negatively affecting the environment.
Two important economic components of milk are protein and fat which determine the quality production of the dairy product. The yield of dairy products like cheese and butter improves with an increase in protein and fat content; however the yield is influenced by milk salts (Bijl *et al.*, 2013) [4]. The association between the components of milk aids in identifying other economic traits of farm animals. It is a crucial quality since it will serve as a criterion for choosing and rearing farm animals that are economically and commercially viable. In view of the above facts, the purpose of present study was to ascertain the effect of breed and lactation on milk composition and determine the nature of the interaction between the components of milk, such as fat, SNF, protein, lactose and electrical conductivity.

## 2. Materials and Methods
The present study was conducted at Instructional Dairy Farm Nagla, College of Veterinary and Animal Sciences, G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand. Experimental work was conducted on 24 Sahiwal and 24 crossbred cows maintained under loose housing system. Milk sample (about 200 ml) was collected from Sahiwal and crossbred cattle having different lactation stage. For this milk collection, after cleaning the teats, first 3-4 streams of milk were discarded, and then sample was collected in sterilized container and preserved till further analysis. The milk composition parameters viz. milk fat, protein, lactose, solid not fat, electrical conductivity and total solid were determined

using milkotronic-Ultrasonic milk lactoscan analyzer (Made in Bulgaria).

### 2.1. Statistical Analysis

The data was analysed with the help of SPSS (Statistical Package for Social Sciences version 21) statistically to test the significance as per methods described by Snedecor and Cochran 1994 [16]. The obtained data were first tabulated and means were calculated using descriptive statistics. Comparison between the groups was done using t-tests and for more than two groups one-way ANOVA was used. Means within the groups were compared using Duncan Multiple Range Test (DMRT), (Duncan, 1995) [8]. Pearson Correlation test was performed to determine the association of different milk components.

## 3. Results and Discussion

### 3.1. Milk composition

The results of milk composition of Sahiwal and crossbred cattle have been presented in Table 1. The results of the present study revealed that the fat % was significantly ($p$<0.001) higher in milk of Sahiwal cattle (5.11±0.12) as compared to Crossbred cattle (4.22±0.13). The SNF % (9.2±0.05 v/s 8.91±0.13) ($p$<0.05) and total solids % (14.3±0.17 v/s 13.14±0.23) ($p$<0.001) were also found to be significantly higher in Sahiwal milk as compared to crossbred milk. The lactose % in Sahiwal milk was numerically higher as compared to cross bred but the difference was not significant. The protein % and electrical conductivity (EC) was similar in Sahiwal and crossbred milk.

**Table1:** Comparison of milk composition of Sahiwal and Crossbred cattle

| SL. No | Traits | Sahiwal | Crossbred |
|---|---|---|---|
| 1 | Fat (%) *** | $5.11^{a}$±0.12 | $4.22^{b}$±0.13 |
| 2 | SNF (%)* | $9.2^{a}$±0.05 | $8.91^{b}$±0.13 |
| 3 | Protein (%) | 3.38±0.02 | 3.31±0.05 |
| 4 | Lactose (%) | 5.12±0.04 | 4.96±0.09 |
| 5 | EC mS/cm | 3.87±0.08 | 3.99±0.05 |
| 6 | TS (%) *** | $14.3^{a}$±0.17 | $13.14^{b}$±0.23 |

$^{a,b}$Values with different superscript across the row differ significantly, ***$p$<0.001, *$p$<0.05
SNF = Solid not fat, EC = Electrical conductivity, TS = Total solid, NS = non-significant

According to Banerjee (2018) [3], the fat and total solid percentages of Indian dairy cattle range from 3.5 to 5.5 and 12.20 to 15 percent, respectively which is in accordance with the present study. Similar findings of significantly high fat ($p$<0.001) and TS % ($p$<0.01) in Sahiwal as compared to Crossbred was reported by Sharma *et al.* (2018) [15]. The present findings coincide with the results of Pattoo *et al.* (2015) [20] where significantly ($p$<0.05) higher fat, SNF and TS was reported in Sahiwal as compared to crossbred cattle. The protein% was also found to be similar. According to Sarakar *et al.* (2006) [14], the difference in lactose percent among Sahiwal, Tharparkar, and Karan-Fries crossbred cattle was not statistically significant which supported the present observation.

### 3.2. Milk Composition in different lactation

Milk composition parameters in 1st, 2nd, 3rd and 4th lactation have been presented in Table 2. The fat content of Sahiwal cattle milk was found to be significantly ($p$<0.05) higher in 1st lactation and showed a decreasing trend from 1st to 4th lactation. However, in crossbred the mean values were similar from 1st to 3rd lactation and decreased from 3rd to 4th lactation. The SNF, protein and lactose % in Sahiwal milk was observed to decrease significantly ($p$<0.05) from 1st to 2nd lactation and its was similar in 2nd, 3rd and 4th lactation. The EC in Sahiwal milk was significantly higher ($p$<0.05) in 3rd lactation and it showed an increasing trend from 1st to 3rd lactation. The TS % was found to be significantly ($p$<0.05) higher in 1st lactation and showed a decreasing trend from 1st to 4th lactation. However SNF, Protein, lactose, EC and TS content did not differ significantly in different lactation in crossbred cattle milk.

**Table 2:** Milk composition of Sahiwal and Crossbred cattle according to different lactation

| Sahiwal | | | | | | |
|---|---|---|---|---|---|---|
| **Lactation** | **Fat** | **SNF** | **Protein** | **Lactose** | **EC** | **TS** |
| 1 | $5.9^{a}$±0.18 | $9.59^{a}$±0.07 | $3.52^{a}$±0.04 | $5.35^{a}$±0.05 | $3.74^{b}$±0.11 | $15.49^{a}$±0.23 |
| 2 | $5.17^{b}$±0.12 | $9.1^{b}$±0.04 | $3.33^{b}$±0.04 | $5.14^{b}$±0.06 | $3.84^{ab}$±0.1 | $14.28^{b}$±0.14 |
| 3 | $4.83^{bc}$±0.14 | $9.05^{b}$±0.05 | $3.34^{b}$±0.03 | $4.95^{b}$±0.03 | $4.23^{a}$±0.2 | $13.89^{bc}$±0.18 |
| 4 | $4.53^{c}$±0.1 | $9.04^{b}$±0.08 | $3.35^{b}$±0.05 | $5.06^{b}$±0.07 | $3.67^{b}$±0.12 | $13.57^{c}$±0.12 |
| **Crossbred** | | | | | | |
| **Lactation** | **Fat** | **SNF** | **Protein** | **Lactose** | **EC** | **TS** |
| 1 | $4.63^{a}$±0.18 | 9.02±0.11 | 3.46±0.11 | 5.05±0.23 | 4.13±0.05 | 13.71±0.15 |
| 2 | $4.4^{a}$±0.18 | 8.96±0.18 | 3.33±0.05 | 5.05±0.07 | 4.01±0.12 | 13.36±0.31 |
| 3 | $4.25^{ab}$±0.23 | 8.8±0.23 | 3.18±0.1 | 4.81±0.13 | 3.85±0.16 | 13.02±0.42 |
| 4 | $3.6^{b}$±0.29 | 8.87±0.46 | 3.29±0.17 | 4.91±0.26 | 3.97±0.08 | 12.47±0.72 |

$^{a,b,c}$Values with different superscript across the columns differ significantly ($p$<0.05)
SNF = Solid not fat, EC = Electrical conductivity, TS = Total solid

Similar findings of significant ($p$<0.05) effect of lactation on fat percentage was reported by Sahu *et al.* (2018) [21]. The authors also observed decreasing trend in milk fat present from 1st to 4th lactation which supported the present findings. Lower fat and SNF content were observed at later lactations than earlier lactations (Vanschoubroek *et al.*, 1964; Boro, *et al.*, 2016) [18, 5]. Fat and SNF are not affected significantly with increasing age of the cows (Patel *et aI.*, 1974) [10].

### 3.3. Correlation among milk composition traits

The correlation of different components of milk in Sahiwal has been presented in Table 3. The fat % was found to show highly significant ($p$<0.01) positive correlation with SNF, protein and TS % and significant ($p$<0.05) positive correlation with lactose %. The SNF % was observed to have highly significant ($p$<0.01) positive correlation with lactose and TS % and significant ($p$<0.05) positive correlation with protein %. Highly significant ($p$<0.01) positive correlation of TS was observed with protein and lactose %. EC was found to be negatively correlated with fat, SNF, lactose and TS, however, the relation was not significant.

Correlation among different composition traits in crossbred cattle have been presented in Table 3. Fat % noted to have high significant ($p$<0.01) positive correlation SNF, protein and TS % and significant ($p$<0.05) positive correlation with lactose %. The SNF % was observed having high significant ($p$<0.01) positive correlation with protein, lactose and TS %. Highly significant ($p$<0.01) positive correlation of protein was observed with lactose and TS %. TS was also positively correlated ($p$<0.01) with lactose. Negative correlation of EC was observed with fat, SNF, protein, lactose and TS, however, the association was not significant.

**Table 3:** Correlation of different constituents of milk of Sahiwal and Crossbred cattle

| **Sahiwal** | | | | | | |
|---|---|---|---|---|---|---|
| **Traits** | **Fat** | **SNF** | **Protein** | **Lactose** | **EC** | **TS** |
| Fat | | 0.77** | 0.64** | 0.49* | -0.14 | 0.98** |
| SNF | | | 0.41* | 0.76** | -0.31 | 0.89** |
| Protein | | | | 0.19 | 0.25 | 0.60** |
| Lactose | | | | | -0.39 | 0.61** |
| EC | | | | | | -0.20 |
| **Crossbred** | | | | | | |
| **Traits** | **Fat** | **SNF** | **Protein** | **Lactose** | **EC** | **TS** |
| Fat | | 0.52** | 0.58** | 0.48* | -0.26 | 0.88** |
| SNF | | | 0.84** | 0.78** | -0.35 | 0.86** |
| Protein | | | | 0.85** | -0.32 | 0.80** |
| Lactose | | | | | -0.25 | 0.72** |
| EC | | | | | | -0.33 |

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Similar findings of present experiment are Yoon *et al.* (2004) [4] reported that the correlation of fat % with SNF and protein % was highly significant ($p$<0.01). Significantly ($p$<0.01) high correlation between fat % and SNF %, fat % and protein % was reported by Chandrakar *et al.* (2017) [6, 7]. Alphonsus *et al.* (2012) [1] reported that TS % was highly significantly ($p$<0.01) correlated with fat and SNF%. Nogalska *et al.* (2018) [9] observed highly significant ($p$<0.01) positive correlation between fat and protein %.

### 4. Conclusion

There was significant difference in Sahiwal and crossbred cow milk composition. Sahiwal cow milk showed significantly higher fat, SNF and total solid as compared to crossbred. Lactation was also seen having significant effect on milk composition. The milk component parameters were highly correlated with each other. These associations indicated that SNF, protein and lactose had a tendency to increase as the fat content increased. Determining to choose fat will therefore automatically improve the TS.

### 5. Acknowledgement

This research was financially supported by College of Veterinary and Animal Sciences, G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand and AICRP on Sahiwal GB Pant University of Agriculture and Technology, Pantnagar, Uttarakhand.

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