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# Effect of milk fat on sensory and chemical attributes of custard apple (*Annona squamosa* L.) enriched *shrikhand* by using stevia

**Kamble KB, Kamble DK and Patange DD**

**Abstract**
*Shrikhand* is indigenous ethnic fermented milk food which assumes special importance due to the pleasant taste. The present investigation was aimed to study effect of level of milk fat on sensory and chemical attributes of custard apple enriched shrikhand. Therefore, study was undertaken to assess various levels of fat in buffalo milk used for making custard apple enriched *shrikhand* by using stevia as a natural sweetener. Buffalo milk was standardized to 3 ($F_1$), 4 ($F_2$), 5 ($F_3$), 6 ($F_4$), and 7 ($F_5$), per cent fat, in which custard apple pulp and readymade market stevia leaf extract (RMSLE W/V) was added at 10 and 1.5 per cent of *chakka*. From the foregoing results it was concluded that there was marginal difference in sensory score for Custard Apple enriched *Shrikhand* by using stevia prepared from milk with 6 and 7 percent fat. Moreover *shrikhand* with high fat content will be quite expensive. In view of this buffalo milk with minimum 6 percent fat is recommended for preparation of the Custard Apple enriched *Shrikhand* by Using Stevia. Therefore *shrikhand* prepared from milk containing 6 percent fat with addition of 10 per cent custard apple pulp and 1.5 per cent readymade market stevia leaf extract (RMSLE W/V) of *Chakka* had improved all the sensory attributes of *shrikhand*. From this investigation, it can be seen that as use of milk with increased fat per cent the total solid, fat, protein and ash were increased significantly ($p<0.05$) and moisture was decreased. Acidity and pH had non-significant effect.

**Keywords:** Fat, buffalo milk, custard apple, readymade market stevia leaf extract (RMSLE), *chakka*, *shrikhand*, sensory and chemical attributes

## Introduction
India is one of the largest milk producer in world from the total milk production, only 7% milk is utilized for the production of fermented milk products (Aneja *et al.* 2002) [1]. In 7% mainly include *curd (Dahi*), *sweetened concentrated curd (Shrikhand*) and *stirred curd (Lassi)*. *Shrikhand* is very popular in Indian states i.e. Maharashtra, Gujarat, Karnataka and some parts of Rajasthan because of its high nutritive, therapeutic value, palatable nature, and characteristic flavour and taste. *Shrikhand* is a semi-soft, sweetish-sour milk product prepared from lactic fermented curd. The curd is partially strained through a muslin cloth to remove the *whey* to produce a solid mass called *chakka*. This *chakka* is mixed with the required amount of sugar to yield *Shrikhand*. *Shrikhand* has typical semi-solid consistency with a characteristics smoothness, firmness and palatability. With the addition of some fruit pulp, improved nutritive and sensory characteristics of *Shrikhand* is obtained. Fruits and vegetables can be used in dairy products as a suitable substrate. These are inherently healthy, pleasing taste, refreshing and contains lots of beneficial nutrients. Nutritional value, digestibility, shelf life, safety and sensory attributes can be enhancing by the fermentation of product otherwise these can be destroyed during thermal processing of food. Because of the change in the economic status and food habit of consumers the other varieties of *shrikhand* such as fruit *shrikhand* are also in great demand. Fat is an important chemical constituent. It contributes the flavour and texture characteristics to *shrikhand*. In order to obtain best quality product, particularly from the point of sensory quality, most appropriate level of fat in the final product is very important.

## Materials and Methods
The present investigation was carried out in the laboratory of Animal Husbandry and Dairy Science, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri. The fresh, clean whole buffalo milk was procured from local market. Good quality custard apple pulp was procured from local market in a single lot.

Good quality readymade market stevia leaf extract (RMSLE) manufactured by Anubhav Biotech Ltd. permitted by FSSAI was procured from ayurvedic medical at Ahemednagar district in a single lot. The freeze-dried culture of LF-40 was procured from National Collection of Dairy culture unit, N.D.R.I., Karnal (Haryana).

**Chemical analysis**

Total solid and ash content of *shrikhand* was determined as per the method described in IS:1479 (Part- II) 1961. Moisture content of *shrikhand* was determined as per SP:18 (Part XI), 1981. Fat in *shrikhand* was determined by Gerber's method described in IS: 1224 (Part II) 1977. Protein content of *shrikhand* was estimated by Micro-Kjeldhal method, AOAC, 1992. The acidity of *shrikhand* was determined as per the procedure SP:18 (Part-XI) 1981. The pH was measured by Oroion-3 star pH bench top pH meter.

**Statistical Analysis**

Data generated during the course of investigation was analysed with the help of statistical design i.e. Completely Randomized Design (CRD) as per Snedecor and Cochran (1967).

**Treatment details**

Buffalo milk was standardized to 3 ($F_1$), 4 ($F_2$), 5 ($F_3$), 6 ($F_4$), and 7 ($F_5$), per cent fat, in which custard apple pulp and readymade market stevia leaf extract (RMSLE W/V) was added at 10 and 1.5 per cent of *chakka*.

Thus treatment details is as under

$F_1$ – *Shrikhand* prepared from 3% fat milk
$F_2$ - *Shrikhand* prepared from 4% fat milk
$F_3$ – *Shrikhand* prepared from 5% fat milk
$F_4$ – *Shrikhand* prepared from 6% fat milk
$F_5$ - *Shrikhand* prepared from 7% fat milk

**Methodology**

**Preparation of custard apple enriched shrikhand by using stevia as a natural sweetener**

The custard apple enriched *shrikhand* by using stevia as a natural sweetener was prepared as per the method suggested by De (2009) with certain modification. Initially buffalo milk was taken and preheated at 38-40 ℃ which was filtered through muslin cloth, then the milk was standardized to 3, 4, 5, 6 and 7 per cent fat.

The milk was then pasteurized at 90 ℃ for 15 minutes and allowed to cool at 30 ℃. The same milk was inoculated with the LF-40 culture @ 1 per cent of milk and permitted to incubate at 30 ℃ for 8-10 hrs. After which curd was formed. Break the curd and put it in muslin cloth and allowed to drain the whey for 8 hrs. Thereon drainage, solid mass was obtained called *chakka*, on which later on custard apple pulp @ 10 per cent and readymade market stevia leaf extract (RMSLE) @ 1.5 percent (W/V) of *chakka* was added. The final product was kneaded and packed in a presterilized polypropylene cup for stored at 6±1 ℃. (Fig.1).

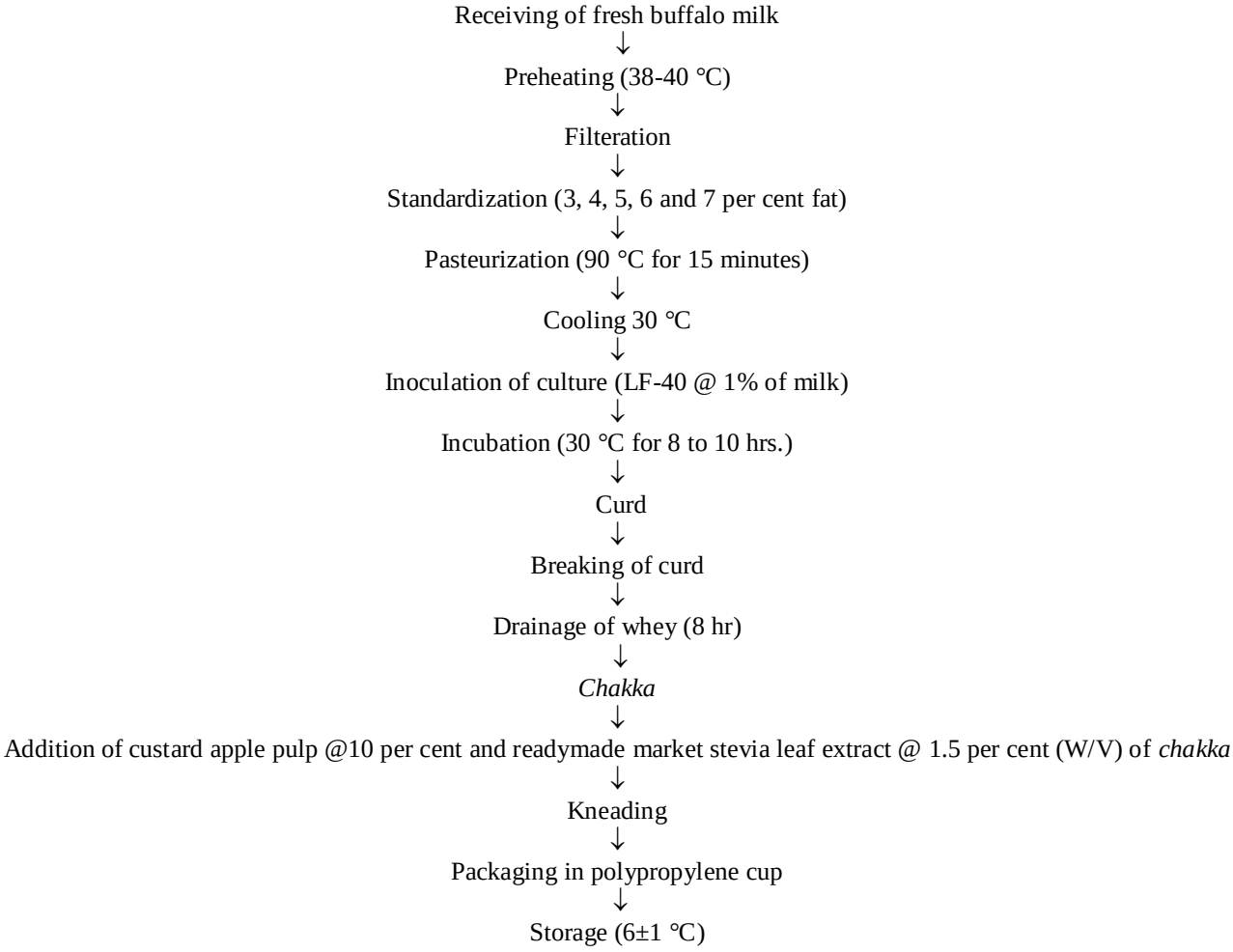


**Fig 1:** Flow diagram for manufacture of custard apple enriched *shrikhand* by using stevia

## Results and Discussion

### Effect of Milk Fat on sensory attributes of custard apple enriched *shrikhand* by using stevia

#### Colour and appearance

It is revealed from Table 1, that the variation in colour and appearance scores due to treatments were observed to be statistically significant ($P<0.05$). The mean scores of colour and appearance of custard apple enriched *shrikhand* added with RMSLE for treatment $F_1$, $F_2$, $F_3$, $F_4$ and $F_5$ were 7.12±0.01, 7.35±0.01, 7.45±0.02, 8.69±0.04 and 8.54±0.01, respectively. The treatment $F_4$ was significantly superior ($P<0.05$) over $F_1$, $F_2$, $F_3$ and $F_5$ treatments.

It was also observed from the above finding that *shrikhand* prepared from milk containing 6 per cent fat given rich colour and appearance where the lowest score recorded in *shrikhand* prepared from milk containing 3 per cent fat. In low fat (3, 4 and 5 per cent) product, judges experienced slightly dull appearance. Such observation are also noted by Ghanbahadur (2016) [3] for pomegranate juice *shrikhand*.

#### Body and texture

It was observed from Table 1 that, the mean score of body and texture of custard apple enriched *shrikhand* for treatment $F_1$, $F_2$, $F_3$, $F_4$ and $F_5$ were 6.83±0.01, 6.96±0.01, 7.37±0.01, 8.31±0.02 and 8.11±0.01, respectively. The treatment $F_4$ was significantly superior ($P<0.05$) over $F_1$, $F_2$, $F_3$ and $F_5$ treatments.

It was also observed from Table 1, that the *shrikhand* prepared from milk containing 6 per cent fat has given rich body and texture whereas the lowest score was recorded in *shrikhand* prepared with 3 per cent fat. Singh *et al.* (2015) [9] also reported the highest score for body and texture score was observed with 6 per cent milk fat. The present findings are in accordance with the reports of Ghanbahadur (2016) [3].

#### Flavour

The data depicted in Table 1, reveals that, the mean scores of flavour of custard apple enriched *shrikhand* for treatment $F_1$, $F_2$, $F_3$, $F_4$ and $F_5$ were 7.27±0.01, 7.34±0.02, 7.45±0.02, 8.42±0.01 and 8.52±0.01, respectively. The treatment $F_5$ superior over $F_1$, $F_2$ and $F_3$ treatments. From the data it looks that, as the level of fat increases the score for flavour was also increases. Statistically the difference between treatment $F_4$ and $F_5$ was non-significant.

It was also observed from above finding that the *shrikhand* prepared from milk containing 7 per cent fat had maximum score for flavour and *shrikhand* prepared with 3 per cent fat had minimum score for flavour. In low fat (3, 4 and 5 per cent) product, judges experienced slightly less mouth feel. The results of this investigation is in closely agreement with Singh *et al.* (2015) [9] who reported that the milk having higher fat per cent produced good flavour in *shrikhand*.

#### Overall acceptability

It was observed from Table 1 that, the mean scores of overall acceptability of custard apple enriched *shrikhand* for treatment $F_1$, $F_2$, $F_3$, $F_4$ and $F_5$ were 7.07±0.02, 7.21±0.01, 7.42±0.02, 8.47±0.01 and 8.39±0.02, respectively. The treatment $F_4$ was significantly superior ($P<0.05$) over rest of treatments. Statistically the difference between treatment $F_4$ and $F_5$ was non-significant.

It was also observed from above finding that the *shrikhand* prepared from milk fat containing 6 per cent fat had maximum acceptability whereas, the lowest scores was recorded in *shrikhand* prepared from 3 per cent milk fat. Singh *et al.* (2015) [9] also found that the maximum overall acceptability score obtained for *shrikhand* prepared from milk having 6 per cent of fat. Kuttabadkar *et al.* (2014) [7] and Thakur *et al.* (2014) [13] also optimized 6 per cent fat in milk for preparation of *shrikhand*.

From the foregoing results it was concluded that there was marginal difference in sensory score for custard Apple enriched *shrikhand* by using stevia prepared from milk with 6 and 7 percent fat. Moreover *shrikhand* with high fat content will be quite expensive. In view of this buffalo milk with minimum 6 percent fat is recommended for preparation of the Custard Apple enriched *Shrikhand* by Using Stevia. Therefor *shrikhand* prepared from milk containing 6 percent fat with addition of 10 percent custard apple pulp and 1.5 percent readymade market stevia leaf extract (RMSLE W/V) of *Chakka* had improved all the sensory attributes of *shrikhand* therefore the 6 percent fat level was considered as an optimized concentration and used for further study.

**Table 1:** Effect of level of milk Fat on sensory (score*) attributes of custard apple enriched *shrikhand* by using stevia

| Treatment | Sensory attributes | | | |
|---|---|---|---|---|
| | Colour and appearance | Body and texture | Flavour | Overall acceptability |
| $F_1$ | 7.12±0.01$^d$ | 6.83±0.01$^e$ | 7.27±0.01$^b$ | 7.07±0.02$^c$ |
| $F_2$ | 7.35±0.01$^c$ | 6.96±0.01$^d$ | 7.34±0.02$^b$ | 7.21±0.01$^b$ |
| $F_3$ | 7.45±0.02$^c$ | 7.37±0.01$^c$ | 7.45±0.02$^b$ | 7.42±0.02$^b$ |
| $F_4$ | 8.69±0.04$^a$ | 8.31±0.02$^a$ | 8.42±0.01$^a$ | 8.47±0.01$^a$ |
| $F_5$ | 8.54±0.01$^b$ | 8.11±0.01$^b$ | 8.52±0.01$^a$ | 8.39±0.02$^a$ |
| S.E(m) | 0.04 | 0.03 | 0.09 | 0.07 |
| CD ($P<0.05$) | 0.12 | 0.10 | 0.28 | 0.22 |

*Means± SE with different superscript indicates the value were statistically significant ($P< 0.05$) within the column.

### Effect of Milk Fat on chemical constituents of custard apple enriched *shrikhand* by using Stevia

**Table 2:** Effect of level of milk fat on chemical constituents of custard apple enriched *shrikhand* by using stevia

| Treatment | Chemical constituents | | | |
|---|---|---|---|---|
| | Moisture (%) | Total solid (%) | Fat (%) | Protein (%) |
| $F_1$ | 78.47±0.02$^a$ | 21.53±0.08$^e$ | 11.42±0.01$^e$ | 6.68±0.03$^e$ |
| $F_2$ | 71.30±0.03$^b$ | 28.70±0.02$^d$ | 15.23±0.01$^d$ | 8.90±0.02$^d$ |
| $F_3$ | 64.12±0.01$^c$ | 35.88±0.01$^c$ | 19.04±0.02$^c$ | 11.13±0.02$^c$ |
| $F_4$ | 56.94±0.02$^d$ | 43.06±0.02$^b$ | 22.85±0.02$^b$ | 13.36±0.02$^b$ |
| $F_5$ | 49.77±0.03$^e$ | 50.23±0.02$^a$ | 26.65±0.03$^a$ | 15.58±0.01$^a$ |
| S.E(m) | 0.06 | 0.04 | 0.03 | 0.03 |
| CD ($P<0.05$) | 0.20 | 0.12 | 0.11 | 0.11 |

| Treatment | Chemical constituents | | |
|---|---|---|---|
| | Ash (%) | Acidity (%LA) | pH |
| $F_1$ | 0.60±0.02$^e$ | 0.95±0.02 | 4.19±0.01 |
| $F_2$ | 0.80±0.02$^d$ | 0.96±0.02 | 4.17±0.01 |
| $F_3$ | 1.00±0.02$^c$ | 0.98±0.01 | 4.16±0.01 |
| $F_4$ | 1.21±0.03$^b$ | 0.99±0.04 | 4.14±0.03 |
| $F_5$ | 1.41±0.02$^a$ | 0.99±0.04 | 4.14±0.03 |
| S.E(m) | 0.03 | 0.08 | 0.04 |
| CD ($P<0.05$) | 0.10 | NS | NS |

*Means± SE with different superscript indicates the value were statistically significant ($P< 0.05$) within the column.

Data in Table 2, show that the moisture, Total solid, fat, protein, ash, acidity and pH in the range of 49.77 ± 0.03 to 78.47 ± 0.02, 21.53 ± 0.08 to 50.23 ± 0.02, 11.42 ± 0.01 to 26.65 ± 0.03, 6.68 ± 0.03 to 15.58 ± 0.01, 0.60 ± 0.02 to 1.41 ± 0.02, 0.95 ± 0.02 to 0.99 ± 0.04 and 4.14 ± 0.03 to 4.19 ± 0.01 per cent, respectively. From this observation it can be seen that as use of milk with increased fat per cent total solid, fat, protein and ash were increased significantly ($P$<0.05) and moisture was decreased. Acidity and pH had non-significant effect. Reddy (1985) and Kamble (2010) also reported the similar variation in the moisture and fat content of *burfi* as affected by the level of fat content in the milk used for *burfi* preparation and Singh *et al*. (2015) [9] noted, the similar variation in the total solid content of *shrikhand* as affected by the level of fat content in the milk used for *shrikhand* preparation.

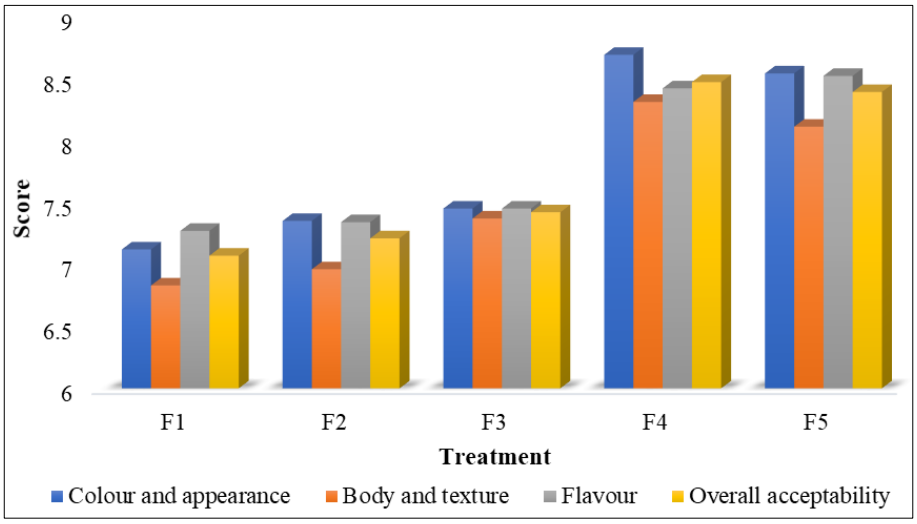


**Fig 2:** Effect of level of milk fat on sensory attributes of custard apple enriched *shrikhand* by using stevia

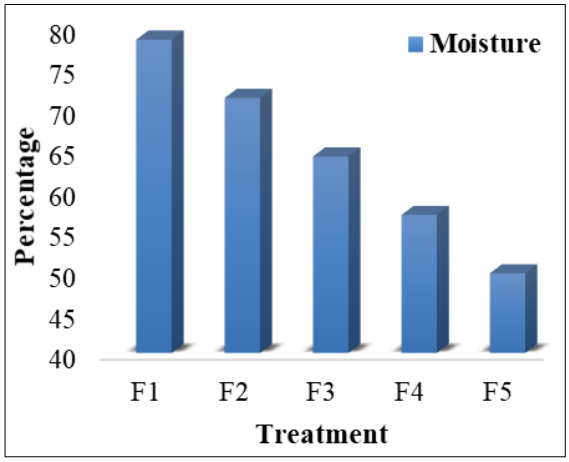


**Fig 3:** Effect of milk fat on moisture content of custard apple enriched *shrikhand*

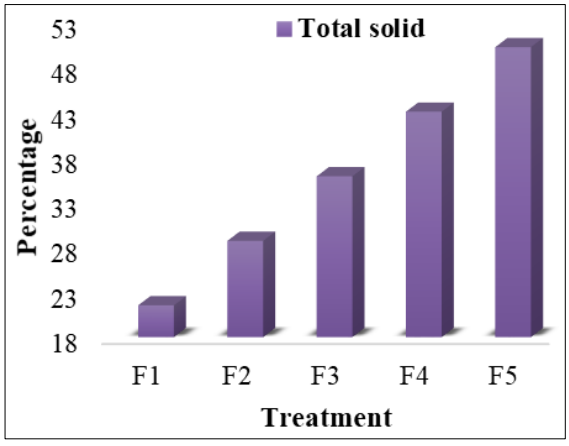


**Fig 4:** Effect of milk fat on total solid content of custard apple enriched *shrikhand*

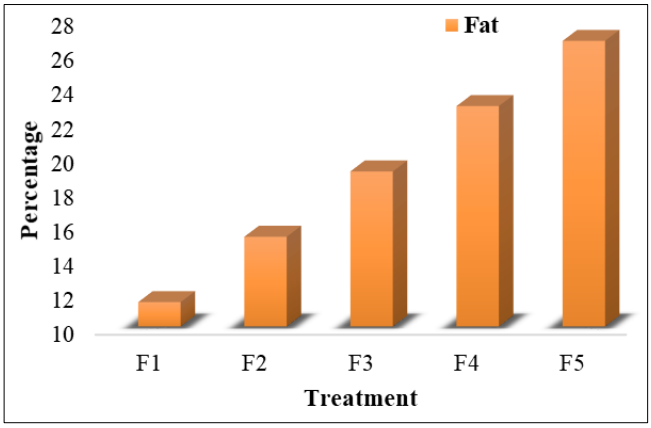


**Fig 5:** Effect of milk fat on fat content of custard apple enriched *shrikhand*

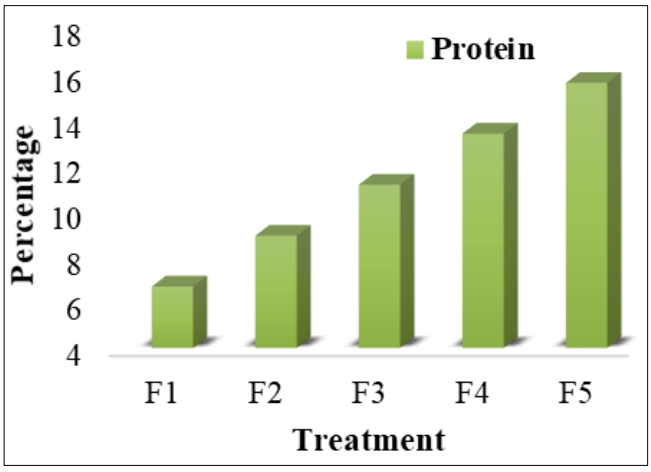


**Fig 6:** Effect of milk fat on protein content of custard apple enriched *shrikhand*

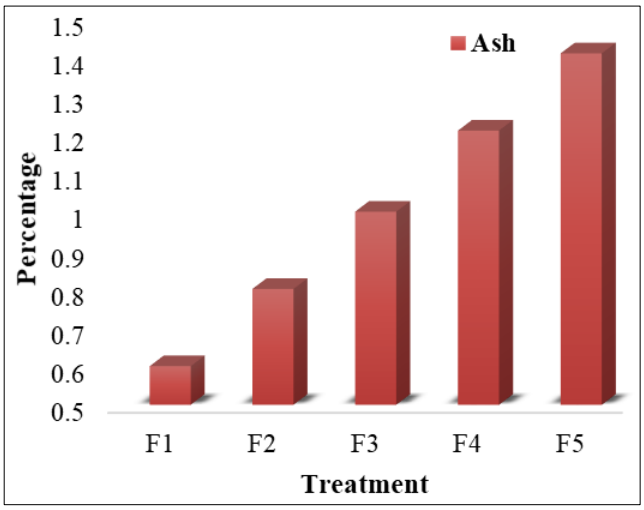


**Fig 7:** Effect of milk fat on ash content of custard apple enriched *shrikhand*

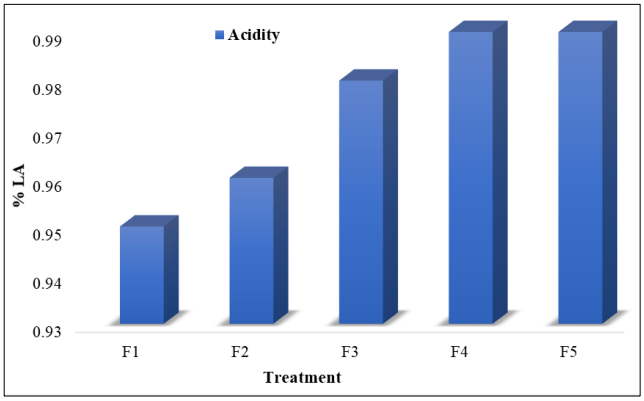


**Fig 8:** Effect of milk fat on acidity (% LA) of custard apple enriched *shrikhand*

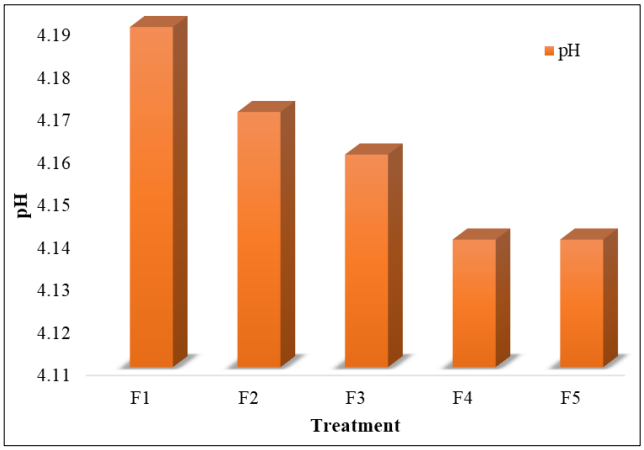


**Fig 9:** Effect of milk fat on pH content of custard apple enriched *shrikhand*

## Conclusions

From the present investigation, it was concluded that, buffalo milk with minimum 6 percent fat is recommended for preparation of the Custard Apple enriched *Shrikhand* by Using Stevia. Therefore *shrikhand* prepared from milk containing 6 percent fat with addition of 10 percent custard apple pulp and 1.5 percent readymade market stevia leaf extract (RMSLE W/V) of *Chakka* had improved all the sensory attributes of *shrikhand*. From this study, it can be seen that as use of milk with increased fat per cent the total solid, fat, protein and ash were increased significantly ($P<0.05$) and moisture was decreased. Acidity and pH had non-significant effect.

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