Effect of Replacement of Sugar with Jaggery Powder on Sensory and Nutritional Quality of Shrikhand

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ABSTRACT

Background: The recent market trend of diabetic products is increasing very fast due to awareness in consumers about the benefits of the products for sound health. It is estimated that around 8-12% of the global population buys diabetic products on regular basis. Shrikhand is fermented dairy product prepared by blending chakka, a semi-solid mass obtained after draining whey from dahi, with sugar and other ingredients. In the preparation process of both sugar and Jaggary powder, sweeteners are different. While manufacturing white sugar, harmful chemicals like phosphoric acid, sulfur dioxide, calcium hydroxide, polyacrylamide and bone char are used. Jaggery is far better than white sugar, because of its nutritional significance of sucrose (C12H22O11), with traces of mineral salts, iron and some fiber. Shrikhand is a highly refreshing and energy dense dairy dessert due to its high fat, protein and carbohydrates content. Hence, the current study aimed at evaluating the effect of Jaggery powder on the sensory quality and Nutritional quality of shrikhand in order to manage and control eating calorie-rich food like sugar increases the risk of diabetes.

Method: In this study Laboratory investigation during 2019-2020 conducted. The experiment was carried out in the Department of Dairy Science Research Centre, Yeshwant Mahavidyalaya Nanded, MS. To utilize jaggery powder in place of sugar, value added shrikhand prepared by replacing 45% sugar replaced with three levels of sugar i.e. 31, 41 and 51% Jaggery powder was used and study was laid in completely randomized design with three replication. The effect of all treated samples and their interaction were studied on the sensory quality of Shrikhand.

Conclusion: In present investigation the effect of Jaggery powder on the sensory and nutritional quality of value added Shrikhand was studied, on the basis of sensory and chemical qualities. There was a significant difference (P<0.05) in overall acceptability scores observed between all treatment combinations. Higher acceptability score (7.99) indicating superior acceptability among experimental samples. The mean liking was in the following trend: SO>S3>S2>S1. The present work showed that Shrikhand (S1) prepared with 41% Jaggery powder had acceptable quality characteristics among all the experimental samples. The nutritional parameters were significantly (p<0.05) differ except protein. It is acceptable that sugar can be replaced with Jaggery powder on an equal weight basis in preparation of shrikhand.

Key words: Chemical quality, Jaggery powder, Sensory quality, Shrikhand, Sugar.

INTRODUCTION

Traditional fermented milk products have played an essential role in the diet of Indians are consumed either as main dishes or along with the meals and gained popularity because of their unique sensory characteristics. Recently attempt has been made to improve the nutritive and sensory characters of shrikhand (Amrakahand) by adding stevia leaf extract powder to evaluate the replacement of sugar with stevia leaf extract powder to blend was increased the quality of Amrakahand and also to produce the product with optimum percentage of sucrose content (Tondare et al.,2019) by adding Gulkand and rose petal powder (Nadal et al., 2012), Ashwagandha powder (Landge et al., 2011) apple with celosia powder(Nigam et al., 2009). In addition with this shrikhand is often prepared by adding saffron to enhance its color, appearance and flavor.

The preparation process of both sugar and Jaggery powder sweeteners are different. While manufacturing white sugar, harmful chemicals like phosphoric acid, sulfur dioxide, calcium hydroxide, polyacrylamide and bone char are used. Jaggery is far better than white sugar. Jaggery is predominantly sucrose (C12H22O11), with traces of mineral salts, iron and some fiber. Consumer deserves novelty product and development in new functional foods advances day by day. Hence the present investigation was aimed to evaluate the effect of Jaggery powder on the chemical properties and sensory quality of shrikhand.

MATERIALS AND METHODS

The experiment was carried out in the Department of Dairy Science Yeshwant Mahavidyalaya Nanded, MS, during the year 2019-20. Material used in the experiment involved...
buffalo milk was procured from the Local market of Nanded city and other ingredients were procured from the super market for the present study. A fresh a good quality Jaggery powder required as sweetening agent was purchased from super market. According to F.S.S.A.I. (2011) Jaggery powder shall be free from substances deleterious to health and can confirm to the legal standard on dry weight basis. It contains nutritional facts given by Pawar et al. (2017).

Production of Shrikhand
Shrikhand was manufactured (Aneja et al., 2002) using fresh, pasteurized buffalo milk with 6% fat and 9% solid-not-fat in a known quantity. Milk was heated at 85°C for 30 minutes, followed by cooling at 28°C. Inoculation was done by using the native starter culture Streptococcus thermophilous and Lactobacillus at the rate of 2% and incubated at 35°C for 8 hour until a firm coagulum was formed and transferred to a muslin cloth and pressed for expulsion of whey for 6 hours, the semi-solid mass left after drainage called chakka, form the base for Shrikhand. (De, 1991). Then at 27°C chakka was mixed the three level of Jaggery powder. Different treatment combinations were added per 100gm of Chakka: S1-Control sample with 100% sucrose (145gm) i.e 0% Jaggery powder, S2-31% Jaggery powder with replacement of sucrose,S3-41% Jaggery powder with replacement of sucrose,S4-51% Jaggery powder with replacement of sucrose.

Chemical analysis
Composite buffalo milk samples were collected from milk producer and analyzed for chemical composition by adopting standard procedures as listed below. Protein content in samples was determined by Kjeldahl method as described in A.O.A.C., (2005). Fat content was determined by modifying the Gerber Test by (Puntambekar,1968).Ash content in milk was determined as described in SP: 18 (Part XI), (1981). Total solids were determined as per procedure given in IS: 1479 (Part-II), (1961). Carbohydrate content by difference method: [100-(Moisture % + fat % + protein % + ash %)]. Energy content by formula method, multiply the number of grams of carbohydrate, protein and fat by 4, 4 and 9, respectively. Sensory evaluation was done by using a panel of six trained judges. They were provided with 9 points hedonic score card for evaluation as described by Gupta (1976). The hedonic degree of liking scale ranges from 1 to 9 where one corresponds with “dislike extremely” and nine corresponds with “like extremely”. The shrikhand was evaluated by the semi trained judges the sensory attributes like flavour, body and texture, Colour and appearance, sweetness and overall acceptability. The optimization of single ingredients and processes were assessed statistically with help of basic statistics. Whereas, combined effect of treatments were assessed by complete randomized design (CRD) with four treatments and three replication. (Amble, 1975) and the data were tested for significance by the one-way analysis of variance (ANOVA) at P<0.05.

RESULTS AND DISCUSSION
Effect of combination on sensory attributes of Shrikhand
Panelists were instructed to evaluate the sample to find out the order of importance of quality attribute among all, first the sample with the lowest amount of added sweetener were presented followed by medium and highest amount of sweetener. After providing information of samples the panelist received a tray of the treated sample coded as S1, S2, S3 and S4 in a series with a spoon and glass of water to cleanse the palate between evaluations.

Effect of combination on sensory quality of Shrikhand is given in Table 2. The mean score of flavor for treatment S1 was highest i.e. 7.80. There was a significant difference (P<0.05) in flavor scores observed in different treatment combinations as S1 followed by S2 (7.24), S3 (6.95), S4 (6.84). Texture attributes of shrikhand score was in the range of 7.1 to 8.2. The mean score of body and texture was highest in S3 i.e. 8.20. Followed by S1 (7.85), S2 (7.56), S4 (7.18) There was a significant difference (P<0.05) in texture, when compared with control, as Jaggery enriched shrikhand was semi-solid, softer than sugar. Maximum color and appearance score of 8.19 found in the control treatment S1 followed by S2 (7.98), S3 (7.47) S4 (6.83), there was significant P<0.05 difference between the experimental samples when prepared with control. The mean score for sweetness ranged from 6.9 to 8.1. The values of the scores of sweetness for treatment S1 scored the highest i.e. (8.1). It also observed from the above findings that the percentage of the addition of Jaggery powder effect significantly (P<0.05) on the sweetness of shrikhand. Overall acceptability score of shrikhand for various treatments varied between 6.9 to 8.0. The sensory evaluations revealed that the shrikhand prepared with 41% (S3) Jaggery powder was equal to the control shrikhand. It was concluded that among all blends used in research, (S3) was the best one for producing good quality shrikhand sweetened with Jaggery powder. There was a significant difference (P<0.05) in overall acceptability scores observed in different treatment combinations.

Effect of Jaggery powder on the nutritional quality of Shrikhand
A recipe with sugar i.e. control and corresponding recipe with a more acceptable level of Jaggery powder was nutritionally analyzed for their proximate composition is given in Table 1 i.e. Moisture. Protein, fat, carbohydrate, ash and energy by stranded procedures. The moisture content of control shrikhand (S1) was 43.23% and the minimum moisture content was observed for Jaggery powder added shrikhand (S3) with 45.86%. The Jaggery powder added shrikhand showed 2.63% decrease in moisture content in comparison with control sample with significant difference (p<0.05) as the free water may have been taken by the Jaggery powder. There was significant increase in ash content from 0.75% to 1.10%, for the control and Jaggery powder added product respectively. The results indicated that ash content showed a significant difference (p<0.05)
between the products. The ash content increased by 0.35% of value added shrikhand in comparison with control due to the addition of Jaggery powder accounts for total inorganic matter in the shrikhand sample S$_2$ reflected in the higher value of total ash. Agreement with the finding of (Lamdande et al. 2018). The results obtained showed that the fat content was 7.76% to 8.80% in control and Jaggary powder added product respectively. An increase of 8.80% was observed in the value added shrikhand and significant difference at p<0.05 was observed. Milk and milk products are rich

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**Table 1:** Effect of different level of Jaggery powder on nutritional quality of Shrikhand.

| Treatment | Moisture (%)  | Total solids (%) | Fat (%)  | Protein (%)  | Carbohydrate (%) | Ash (%)  | Energy (kcal) |
|-----------|---------------|------------------|----------|--------------|------------------|----------|---------------|
| S$_0$     | 43.23±0.50    | 56.76±0.50       | 7.76±0.14 | 7.50±0.37    | 40.75±0.88      | 0.75±0.02 | 262           |
| S$_2$     | 45.86±0.18    | 54.13±0.18       | 8.80±0.20 | 7.18±0.36    | 37.38±0.65      | 1.10±0.05 | 257           |

(All values are given in Mean ± S.E). where n=3, *:* Values with the same superscript within the same column are not significantly different (P<0.05).

**Table 2:** Effect of combination on sensory attributes of Shrikhand.

| Treatment | Flavour | Body and texture | Colour and appearance | Sweetness | Over all acceptability |
|-----------|---------|------------------|-----------------------|-----------|------------------------|
| Mean      | S.E.    | Mean             | S.E.                  | Mean      | S.E.                   | Mean      | S.E.       |
| S$_0$ (with sugar) | 7.803   | 0.312            | 7.850                 | 0.218     | 8.183                  | 0.074     | 8.193      | 0.385     | 8.003      | 0.125     |
| S$_1$ 31% | 6.950   | 0.087            | 7.567                 | 0.159     | 7.477                  | 0.079     | 7.200      | 0.153     | 7.293      | 0.100     |
| S$_2$ 41% | 7.240   | 0.192            | 8.203                 | 0.064     | 7.987                  | 0.104     | 7.800      | 0.051     | 7.997      | 0.038     |
| S$_3$ 51% | 6.843   | 0.167            | 7.183                 | 0.074     | 6.830                  | 0.387     | 6.920      | 0.133     | 6.940      | 0.047     |
| C.D.      | 0.682   | 0.476            | 0.687                 | 0.207     | 0.219                  | 0.310     | 0.121      |           |            |
| SE(m)     | 0.206   | 0.144            | 0.207                 | 0.219     | 0.086                  |           |            |
| SE(d)     | 0.291   | 0.203            | 0.293                 | 0.310     | 0.121                  |           |            |
| C.V.      | 4.950   | 3.230            | 4.715                 | 5.039     | 1.961                  |           |            |

(Mean values are averages of three replications. All values are given in mean significantly different CD at P<0.05).
sources of proteins. Protein value of shrikhand was 7.48 to 7.18% for the control and value added product respectively. There was no significant (p>0.05) increase in the protein content between experimental and control samples. The carbohydrate content was 40.75% for control and 37.38% for \( S_2 \) sample. An increase of 3.37% was observed in the value added shrikhand. It may be due to more moisture content in the Jaggery powder agreement with the finding of (Lamdande et al. 2018). The percentage of total solid was within the range of 47% to 56%. TS content of experimental was lowered due to addition of Jaggery powder. As Jaggery powder have more moisture content than the sugar. Agreement with the finding of (Pawar et al. 2017). The energy content was 262 Kcal/100g for control and 257 Kcal/100g for the value added shrikhand. Addition of Jaggery powder showed a decrease of 2% in the energy content.

**CONCLUSION**

From the present investigation, it is concluded that the Shrikhand prepared with 41 per cent Jaggery powder (\( S_2 \)) is more acceptable. The cost of product obtained using Jaggery powder can be reduced. The product made with Jaggery powder has various health benefits.

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