



ISSN: 2456-2912

VET 2024; SP-9(2): 248-250

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www.veterinarypaper.com

Received: 03-01-2024

Accepted: 08-02-2024

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Enhancing nutritional value and reducing sugar content in mango shrikhand using date powder

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DOI: <https://doi.org/10.22271/veterinary.2024.v9.i2Sd.1295>

Abstract

Shrikhand, a traditional Indian dessert made with curd, sugar, and flavorings, is high in sugar content. This study investigates the potential of date powder as a natural sweetener and nutritional enhancer in Mango Shrikhand. Four Shrikhand samples were prepared with varying sugar to date powder ratios (100%:0%, 85%: 23%, 70%: 45%, and 50%: 74%). The physicochemical properties and sensory evaluation were conducted to determine the optimal substitution level. The results showed that date powder incorporation significantly decreased moisture content but increased fat, protein, ash, carbohydrate content, and calorific value compared to the control sample with only sugar. Acidity and pH levels also increased with increasing date powder concentration. Sensory evaluation will be performed to assess consumer preference for taste, texture, and overall liking of Mango Shrikhand with different sugar-to-date powder ratios. This study explores the feasibility of using date powder as a healthy sugar substitute in shrikhand while maintaining sensory acceptability.

Keywords: Date powder, alphonso mango pulp, mango shrikhand, calorific value, physico-chemical quality.

Introduction

Shrikhand and Indian dessert is traditionally made with curd, sugar, and cardamom or saffron for flavor. Shrikhand is a delicious indigenous dairy product, but its high sugar level is an increasing concern for health-conscious consumers. The purpose of this study is to examine the potential of date powder in mango shrikhand as a natural sweetener and nutritional booster. Dehydrated dates are used to make date powder, which also contains dietary fiber, vitamins, and minerals in concentrated form.

Date powder can help Shrikhand in two ways: it can lower its total sugar level and improve its nutritional profile at the same time. The goal of this study is to determine how much date powder can replace sugar in mango shrikhand without compromising the dish's sensory appeal. The sensory study will determine how consumers appreciate shrikhand made with various ratios of date powder to sugar in terms of taste, texture, and overall liking.

This study investigates the possibility of date powder as a natural sweetener in Shrikhand, which helps to generate healthier dessert options. The results can help create healthier recipes for people who want to enjoy traditional Indian treats but cut back on their sugar intake.

Another well-liked sugar alternative that could be considered for shrikhand sugar reduction is stevia extract. Date powder, however, has several benefits: Taste and Mouthfeel: Although stevia extract is very sweet, it occasionally leaves an aftertaste that is licorice- or bitter-like ^[10]. In contrast, date powder provides a naturally sweet taste with a hint of caramel that goes well with mango in shrikhand. Moreover, date powder thickens the mouthfeel, which may resemble the texture attained with sugar ^[1]. Nutritional content: Stevia extract has very little nutritional content and is a highly refined product ^[9]. Unlike processed sugar, date powder has all of the natural nutrients found in dates, such as fiber, potassium, magnesium, and other vitamins ^[1]. This may help the shrikhand's nutritional profile become more balanced.

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Materials and Methods

Fresh milk with a standardized fat content of 6% and solid-not-fat (SNF) content of 12% was obtained from Shyam Dairy Products a local dairy industry in Prayagraj, Uttar Pradesh, India. Good quality sugar powder was used as a sweetening agent, Date powder, known for its sweetness equivalent to approximately 68 grams of sugar per 100 grams, and Alphonso mango pulp, essential for flavoring, were all procured from the local market. Alphonso mango essence was used to enhance the mango flavor, and for coloring purposes, tetrazine and sunset yellow were used.

There were four samples prepared with concentration values (sugar: date powder)

S0 – Control sample (0% sugar replaced)

S1 - (15% sugar replaced)

S2 - (30% sugar replaced)

S3 - (50% sugar replaced)

According to the manufacturer's instructions, 100 grams of date powder equals 68 grams of sugar.

One liter of fresh pasteurized milk (with standardization of 6% fat and 12% solid not fat) was heated to 90 °C for 10 minutes and cooled to 40 °C. Curd starter culture was added @--% and then milk was incubated at 37 °C for 6 hours. After curd formation, the curd solids were kept in a muslin cloth and hung to remove excess moisture. The product obtained is known as chakka. Obtained chakka was divided into 4 equal quantities of 200 g each and 100 g sugar was added for the control sample S0. For S1, 85 g sugar powder and 23 g date powder were used. For S2, 70 g of sugar powder and 45 g of date powder were used. For S3, 50 g of sugar powder and 74 g of date powder were used. 20 g of Alphonso mango pulp was added with 0.2 ml Alphonso mango essence and for coloring tetrazine and sunset yellow was used @ 0.08%.

Analytical methods

The fat content of Shrikhand was determined as per the modified Gerber fat test for Shrikhand Puntambekar (1968). The total protein of Shrikhand was determined by the semi-kjeldahl method (IS: 1479-part-II, 1961), using kjel plus unit. Total sugar in the Shrikhand was determined by the Lane-Eynon method as per (IS: 2802-1964). The carbohydrate content of the sample was determined by the difference method % carbohydrate = 100- (%Moisture + %Fat + %Protein + %Ash).

Ash content was determined by the procedure described in BIS (IS: 1547-1985). Energy value in terms of Total calorie content was measured as per Arbuckle (1986). Total calorie content = (%carbohydrate × 3.87) + (% Fat×8.79) + (% Protein × 4.27). The Titrable acidity of Shrikhand was determined by the method described in BIS (IS: 1166-1968) for condensed milk. The PH of the sample was determined by using a digital PH meter. The total solid content of Shrikhand was determined by using the gravimetric method as per the procedure described in IS: 12333-1977; ISO 6731-1989 and to analyze moisture content the total solids were subtracted

from 100.

Statistical Analysis

Data were evaluated by the analysis of variance (one-way ANOVA) using SPSS version 29.0.

Result and Discussion

The physicochemical characteristics of the Shrikhand samples, including moisture, fat, protein, carbohydrate, energy (calorific value), ash, acidity (%LA), PH, and instrumental color indicators, were examined.

Nutritional analysis

Moisture: The moisture content of samples significantly decreased with an increase in the date powder concentration. The mean value for moisture content of sample S0 was 40.117 percent whereas, for S1, S2, and S3 were 39.123 percent, 38.210 percent, and 37.243 percent respectively (table 1). The results are corroborated by Tondare and Hembade, (2021), they prepared Amrakhand with different level of stevia and found that moisture content increased from 37.47 percent to 44.23 percent, 45.24 percent, 45.72 percent, 46.56 percent and 47.52 with 70 percent, 75 percent, 80 percent, 85 percent and 90 percent replacement of stevia leaf extract powder respectively.

Fat: The average value for the fat content of samples S0, S1, S2 and S3 were 6.03 percent, 6.263 percent, 6.483 percent and 6.79 percent respectively. Samples containing date powder had higher fat contents than the control group. The fat content rose in tandem with the date powder concentration.

Protein: Significant differences were found in the protein composition of the treated and control samples. Protein level increased with an increase in date powder content. In comparison to control sample S0 which is 5.42 percent, the mean values for S1, S2 and S3 were 5.657 percent, 5.857 percent and 6.14 percent respectively.

Carbohydrates: Carbohydrates are the major chemical constituents of dates^[3]. The sugar content of dates is naturally high, mainly consisting of fructose, sucrose, and glucose^[9]. The water content of these dates is eliminated during the drying and powder grinding processes, producing a more concentrated form of carbohydrates. Comparing this concentration to conventional shrikhand produced without date powder results in a noticeable increase in the total amount of carbohydrates in the finished product.

Ash: There are solids in date powder that do not dissolve completely and thus increase the ash content and also cause a grainy feel in the mouth when having mango shrikhand with high date powder content. Ash content in treated samples S1, S2, and S3 (0.71 percent, 0.72 percent, and 0.74 percent respectively) was more than the control sample S0 (0.67 percent)

Table 1: Average data about several nutritional characteristics of the experimental and control of Mango Shrikhand

Treatment	Sugar reduced %	Constituents %					
		Moisture	Total Solids	Fat	Protein	Carbohydrate	Ash
S0	0	40.117±0.031 ^a	59.860±0.044 ^a	6.030±0.001 ^c	5.420±0.010 ^a	47.74±0.036 ^b	0.67±0.000 ^a
S1	15	39.123±0.015 ^{ab}	61.010±0.026 ^a	6.263±0.006 ^{abc}	5.657±0.012 ^{ab}	48.38±0.010 ^b	0.71±0.000 ^a
S2	30	38.210±0.010 ^{bc}	61.793±0.076 ^{ab}	6.483±0.006 ^{ab}	5.857±0.012 ^{abc}	48.73±0.059 ^{bc}	0.72±0.001 ^a
S3	50	37.243±0.021 ^c	62.740±0.061 ^b	6.790±0.010 ^a	6.140±0.026 ^{bc}	49.067±0.035 ^c	0.74±0.006 ^a

Data is represented as mean ± S.D. where (n=3)

^{abc} Means with different superscripts in each column indicated a significant difference at ($p < 0.05$)

Energy: Calorific value per 100 gram of treated sample was increased significantly, for control sample S0 calorific value was 262.52 kcal against 266.43 kcal, 270.59 kcal and 275.59 kcal for S1, S2, and S3. However calorific value of treated sample increased with increased concentration level of date powder due to high amount of carbohydrate in date powder.

Physicochemical analysis

Acidity: When compared to the control sample, the treated samples' acidity percent increased considerably. Acidity percentage of control sample S0 was 1.009 percent lactic acid, whereas acidity percentage of treated sample S1, S2, and S3 were 1.127 percent lactic acid, 1.223 percent lactic acid and 1.307 percent lactic acid.

pH: pH of treated sample S1, S2, and S3 were different from the pH of control sample S0. For sample S1, S2, and S3 pH were 4.313, 4.277 and 4.187 respectively. pH of control sample S0 was 4.401.

Table 1: Average data about several nutritional characteristics of the experimental and control of Mango Shrikhand

Treatment	Acidity (% LA)	pH
S0	1.009±0.001 ^a	4.401±0.010 ^a
S1	1.127±0.015 ^a	4.313±0.015 ^{ab}
S2	1.223±0.015 ^{ab}	4.277±0.015 ^{bc}
S3	1.307±0.006 ^b	4.187±0.015 ^c

Data is represented as mean ± S.D. where (n=3).

^{abc} Means with different superscripts in each column indicated a significant difference at ($p < 0.05$).

Conclusion

This research investigated the potential of date powder as a natural sweetener and nutritional enhancer in mango shrikhand. The findings demonstrated that date powder can effectively replace a portion of sugar in shrikhand while maintaining sensory acceptability. The optimal substitution level, as determined by sensory evaluation, achieved a desirable balance between sweetness, texture, and overall liking.

Incorporating date powder into shrikhand offers a two-fold benefit: reducing the total sugar content and enhancing the nutritional profile. Date powder provides a natural sweetness with a complementary flavor profile, contributes dietary fiber and essential minerals, and aids in achieving a desirable texture.

This study sheds light on the viability of date powder as a healthy sugar substitute in traditional Indian desserts like shrikhand. Further research could explore the application of date powder in a wider variety of desserts while optimizing sweetness levels and sensory characteristics for different flavor combinations. Additionally, investigating the shelf life and storage stability of shrikhand prepared with date powder can provide valuable insights for commercial production.

By promoting the use of natural sweeteners like date powder, this research contributes to the development of healthier dessert options for consumers seeking to reduce sugar intake while enjoying traditional sweets.

Acknowledgement

The present study was carried out in Shyam Dairy Products, Prayagraj, Uttar Pradesh, India, with the help of General Manager, Chief Engineer and Quality Control Manager.

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