Effect of addition of inulin powder on chemical, organoleptic and microbiological properties of Shrikhand

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Abstract

The objective of this study was to examine the effect of inulin powder on chemical, organoleptic, and microbial properties of. It is observed that addition of inulin powder in shrikhand up to 3% level in chakka had significantly (P<0.05) decreases titratable acidity, pH, moisture, fat, protein, content in shrikhand, whereas, viscosity, total carbohydrates, ash, fiber, total solids content increases significantly (P<0.05) as compare to control. It was observed that addition of inulin powder had significant (P<0.05) effect on body and texture as compare to flavour, color and appearance, sweetness and overall acceptability of the shrikhand. In respect to the microbiological properties, increasing the level of inulin increases the Total Plate Count and Yeast and Mould count in shrikhand.

Keywords: shrikhand, inulin, physic-chemical, organoleptic, microbial

Introduction

Shrikhand is semi solid, sweetish-sour fermented milk product is prepared by fermentation of milk with lactic acid bacteria expulsion of whey from the curd to yield chakka followed by mixing with sugar, flavoring agent and spices, charoli, cardamom, nutmeg, saffron and almond are added to improve the taste and nutritional quality. Generally cow or buffalo milk is used for manufacture of chakka which gives higher overrun and receives consumer’s preference (Aneja et al., 1977) [3]. Currently, dietary fiber is considered as a key ingredient for improving human health and the attention towards dietary fiber enriched foods has been intensified manifolds due to its health promoting properties. Inulin is a storage carbohydrate in plants, having fructose moieties joined by a-(2-1) D frutosyl linkages and is resistant to digestion in the human small intestine due to the a configuration of anomeric C-2 but it can be fermented in large intestine. Almost 90% of the inulin passes to the colon and digested by bacteria present there (Shoib et al., 2016). Due to its ability to act as a dietary fiber and its bifidogenic nature, inulin may represent a functional food ingredient in a health context (Karimi et al., 2015) [13]. The importance of dietary fibers in the diet has been recognized now days. Dietary fibers can provide a multitude of functional properties when they are incorporated in food systems. Thus, fibers addition contributes to the modification and improvement of the texture, sensory characteristics and shelf-life of foods due to their water-binding capacity, gel forming ability, fat mimetic, anti-sticking, anti-clumping, texturising and thickening effects (Thebaudin et al., 1997; Yangilar, 2013; Dello et al., 2004) [23, 25, 54]. Dietary fiber have beneficial physiological effect like improved laxation, attenuation of blood cholesterol, attenuation of post prandial blood glucose, influence of immune function, fermentability and production of SCFAS (short chain fatty acids), decreasing of intestinal transits time, increasing of stool bulk (EU, 2008) [5]. They have technical functionality relating to texture, as well as nutritional functionality relating to health (Ramirez et al., 2010; Ajila and Prasada Rao, 2013) [17, 2]. Milk and milk products considered as a vehicle for dietary fiber would not only take care of their own role in human health but could also enhance the health fullness of the diet as a whole. Hence considering the benefits of supplementation of fiber in the diet; with respect to its nutritional, medicinal value and technological properties. It is decided to study the effect of addition of inulin powder on physic-chemical, organoleptic, microbiological and properties of shrikhand.
Materials and Method

Treatment details

Inulin powder was added at different levels viz., 1, 2, and 3 percent on the basis of weight of chakka in T₀, T₁, T₂ and, T₃ treatments respectively before addition of powdered sugar in shrikhand preparation. The control (T₀) shrikhand was prepared without addition of inulin powder.

Preparation of shrikhand

For preparation of control shrikhand and experimental shrikhand buffalo milk was procured from the Dairy Unit, Department of Animal Husbandry and Dairy Science, college of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. This milk was standardized to 6 percent fat before preparation of chakka. Shrikhand was prepared according to the method given by Patel, (2013) [16] Process flow chart for the preparation of shrikhand is given in Figure 1.

Chemicals

The readymade edible inulin powder was procured from Sanjeevanam AVA products and services AT-19/3, Murthy Nagar Kathirvedu, Chennai-600066. The chemicals used in this study for chemical analysis and microbial study were of analytical grade.

Chemical analysis

The shrikhand blended with inulin powder and without inulin (control) were chemically analyzed for moisture as per procedure described by ISI: 2785 (1964), fat by ISI: 1224 (part II) (1977) [12], protein as per the procedure described in ISI: (1981) [11], ash by ISI: 1547 (1985) [8], total solids estimated as per the procedure described in ISI: (1981) [11], carbohydrate were determined by subtraction method and dietary fiber were estimated as per the method described in AOAC method (1975) [1].

Organoleptic evaluation

The organoleptic attributes of shrikhand were analyzed in terms of its flavour, color and appearance, body and texture, sweetness and overall acceptability by a semi-trained panel consisting of ten members from the Department of Animal Husbandry and Dairy Science and College of Food Technology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani using nine point hedonic scale (Gupta 1976) [6]. (1 = dislike extremely; 9 = like extremely). Sensory evaluation was done at room temperature.

Microbial analysis

Microbiological parameters were determine by using standard procedure for Total Plate Count by method cited in IS: 5550 (1970) using Nutrient Agar as Medium, Yeast and Mould count by method cited in IS: 5550 (1970) using Potato Dextrose Agar as Medium and Coliform count by method cited in IS: 5550 (1970) using Violet Red Bile Agar (VRBA) as medium.

Statistical analysis

All the data were expressed as mean ± Standard error of mean calculated from four replications of experiment by using Completely Randomized Design (CRD). One way analysis of variance (ANOVA) was applied to measure the test for significance as described by Panse and Sukhatme (1985).
Results and Discussion

Effect of addition of inulin powder on chemical composition of shrikhand

The effect of different levels of inulin powder on chemical properties viz., titratable acidity, pH, moisture, fat, protein, total carbohydrates, ash, fiber and total solids of shrikhand was shown in Table 1. There was significant (P<0.05) decrease in titratable acidity, pH, moisture, fat and protein content of shrikhand was observed with increasing the level of inulin. The control shrikhand had significantly (P<0.05) higher in titratable acidity, pH, moisture, fat, protein and content than all experimental shrikhand samples. The decreasing moisture content could be due to utilization of water by inulin in gel formation. The results recorded in present investigation where comparable with Syed and Ghosh (2017) [22] reported that increasing level of inulin in processed cheese decreases moisture, fat, protein content of the processed cheese. Increased level of inulin in shrikhand results in significantly (P<0.05) increasing the ash, fiber, total carbohydrates and total solid content of shrikhand. The ash, fiber, total carbohydrates and total solid content of shrikhand blended with 3 per cent inulin were found highest. The findings of present study where similar with Suvera et al., (2017) [21] reported that ash, fiber, total carbohydrates and total solid content in shrikhand increases with increase in addition of inulin.

Effect of addition of inulin powder on the sensory attributes of shrikhand

The effect of varying levels of inulin powder on sensory attributes viz., Flavour, colour and appearance, body and texture, sweetness and overall acceptability of shrikhand was shown in Table 2. Inulin powder in shrikhand (T2) secure significantly (P<0.05) highest score for flavor, body and texture, color and appearance, sweetness and overall acceptability as compare to other treatments. Significant (P<0.05) increase in overall acceptability score was observed. Highest score for overall acceptability was obtained for T2 as compared to other treatments of experimental shrikhand. The results were comparable to those of Suvera et al., (2017) [21] reported significantly increase in flavor, color and appearance, body and texture and overall acceptability score with increasing level of inulin in shrikhand.

Effect of addition of inulin fiber on microbiological properties of shrikhand

The ash, fiber, total carbohydrates and total solid content of shrikhand blended with 3 per cent inulin were found highest. The findings of present study where similar with Suvera et al., (2017) [21] reported that ash, fiber, total carbohydrates and total solid content in shrikhand increases with increase in addition of inulin.

### Table 1: Effect of addition of inulin powder on chemical composition of shrikhand

| Chemical Constituent | T0 | T1 | T2 | T3 | CD (P < 0.05) |
|----------------------|----|----|----|----|--------------|
| Titratable acidity   | 0.95 ± 0.006b | 0.89 ± 0.007b | 0.96 ± 0.006b | 0.039 |
| Viscosity            | 47.51 ± 1.388c | 50.55 ± 0.266c | 52.29 ± 0.980d | 5.133 |
| pH                   | 4.325 ± 0.031b | 4.28 ± 0.004b | 4.22 ± 0.058b | 0.153 |
| Moisture             | 45.37 ± 0.313b | 44.41 ± 0.266c | 42.89 ± 0.039d | 0.178 |
| Fat                  | 6.20 ± 0.007c | 5.78 ± 0.036c | 5.70 ± 0.017c | 0.065 |
| Protein              | 5.70 ± 0.008c | 5.68 ± 0.011c | 5.61 ± 0.015c | 0.041 |
| Total Carbohydrate   | 41.19 ± 0.196b | 41.63 ± 0.196b | 42.39 ± 0.094c | 0.640 |
| Ash                  | 0.63 ± 0.030a | 0.66 ± 0.020a | 0.678 ± 0.013a | 0.063 |
| Fiber                | 0.89 ± 0.017c | 1.81 ± 0.076c | 2.78 ± 0.027a | 0.128 |
| Total Solid          | 54.62 ± 0.313b | 55.08 ± 0.63b | 57.11 ± 0.038b | 1.144 |

Values are Mean ± Standard Error

### Table 2: Effect of addition of inulin powder on sensory attributes of shrikhand

| Treatment | Flavor | Color and Appearance | Body and Texture | Sweetness | Overall Acceptability |
|-----------|--------|----------------------|-----------------|-----------|-----------------------|
| T0        | 7.43 ± 0.105c | 7.79 ± 0.096c | 7.99 ± 0.070c | 7.97 ± 0.048b | 7.95 ± 0.052c |
| T1        | 7.69 ± 0.114b | 8.25 ± 0.074ab | 8.09 ± 0.076bc | 8.49 ± 0.041c | 8.37 ± 0.033ab |
| T2        | 8.01 ± 0.045c | 8.42 ± 0.069b | 8.44 ± 0.085c | 8.56 ± 0.0101c | 8.66 ± 0.029d |
| T3        | 7.92 ± 0.027abc | 8.03 ± 0.097bc | 8.29 ± 0.097abc | 7.55 ± 0.073bc | 8.45 ± 0.058c |

CD P < 0.05

Values are Mean ± Standard Error

### Table 3: Effect of addition of inulin powder on microbiological properties of shrikhand

| Treatment | Microbiological Properties | Yeast and Mould Count cfu / gm |
|-----------|-----------------------------|-------------------------------|
| T0        | 3.35 ± 0.117d | 2.080 ± 0.619d |
| T1        | 4.07 ± 0.085c | 3.43 ± 0.370d |
| T2        | 6.46 ± 0.137b | 5.28 ± 0.968b |
| T3        | 8.02 ± 0.077a | 6.33 ± 0.340b |

CD P < 0.05

Values are Mean ± Standard Error

Value with different superscript are significantly differed at P < 0.05
The effect of varying levels of inulin powder on Total Plate Count, Yeast and Mould count, Coliform count) of shrikhand was shown in Table 3. The increasing trend was observed in Total Plate Count. In respect of Total Plate Count significantly (P<0.05) lowest count was observed for T0 and highest score for control (T5). Significant (P<0.05) increase is observed in respect of Total Plate Count in T2 and T3. Yeast and Mould count increased from T0 to T3. Significant (P<0.05) increase was observed in Yeast and Mould count for T3. The Total Plate Count and Yeast and Mould count of shrikhand was increased with decreasing the moisture content as the level of inulin in shrikhand increases. Coliform in any dairy product indicate the hygienic condition maintained during production and packaging. All the experimental shrikhand samples were free from coliform count. The results are in accordance with Kolape et al. (2010) [14].

Conclusions
Inulin powder was added in shrikhand as a source of soluble fiber, its addition up to 3 per cent significantly reduces the titratable acidity, pH, moisture, fat, protein, whereas, viscosity, ash, fiber, total carbohydrate and total solid content of shrikhand significantly increases. It also showed that experimental (T2) shrikhand scored highest score for all sensory attributes. Total Plate Count, Yeast and Mould count of shrikhand increases towards higher level of incorporation of inulin. Thus it can be concluded that inulin could be successfully incorporated in shrikhand up to 2 per cent without adversely affecting the sensory as well as nutritional quality of finished product.

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