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

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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 Kalakand. It is observed that addition of inulin powder content in Kalakand up to 2% level had significantly ($P < 0.05$) decreases moisture, fat, protein, total carbohydrates content in Kalakand whereas, 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 Kalakand. In respect to the microbiological properties, increasing the level of inulin powder decreases the Total Plate Count and Yeast and Mould count in Kalakand. Our results suggest that inulin powder can be added into Kalakand up to 2% without affecting its overall quality characteristics.

Keywords: Kalakand, inulin, inulin powder, chemical, organoleptic, microbial

Introduction

Kalakand is one of the indigenous milk product obtained by heat desiccation/concentration of whole/standardized milk with subsequent addition of sugar and proper coagulant. It was seen that sensory scores for all sensory attributes of Kalakand was different as the Kalakand made from cow milk and milk with high acidity has got lower acceptability whereas Kalakand obtained from buffalo milk was more acceptable. Generally, *Danedar* type of *Khoa* is used for preparation of Kalakand and for the preparation of *Danedar Khoa*, buffalo milk is more suitable than cow milk due to higher amount of fat. Likewise, addition of appropriate amount of coagulant i.e. citric acid and sugar is also very important as both these factors greatly affect the texture and taste of the product (Muley and Landge, 2012) [14]. Now a day's dietary fiber is gaining more importance in human diet due to its important role in human health. Inulin is a natural soluble dietary fiber derived from chicory root, garlic, wheat, bananas, and artichokes, and so it has always been part of the human diet (Niness 1999) [16]. 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 α -(2-1) D fructosyl linkages and is resistant to digestion in the human small intestine due to the 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 (Shoaib *et al.*, 2016) [17]. 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) [12]. 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. Nutritionally, Inulin and its derived fructo-oligosaccharides can stimulate health promoting gut micro flora, relief constipation, improve calcium availability (Lopez-Molina *et al.*, 2005) [13]. 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) [22, 23, 3]. 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) [15, 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 healthfulness 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 chemical, organoleptic and microbiological properties of Kalakand.

Materials and Method

Treatment details

Inulin powder was added at different levels viz., 0.5, 1.0, 1.5 and 2.0 percent on the basis of milk volume in T₁, T₂, T₃ and T₄ treatments respectively with addition of powdered sugar in Kalakand preparation. The control (T₀) Kalakand was prepared without addition of inulin powder.

Preparation of Kalakand

For preparation of control Kalakand and experimental Kalakand buffalo milk was procured from the Dairy Unit Department of Animal Husbandry and Dairy Science, college of Agriculture, Vasant Rao Naik Marathwada Krishi Vidyapeeth, Parbhani. This milk was standardized to 6 per cent fat before preparation of Kalakand. Kalakand was prepared according to the method given by De (1982) [4]. Process flow chart for the preparation of Kalakand is given in Figure 1.

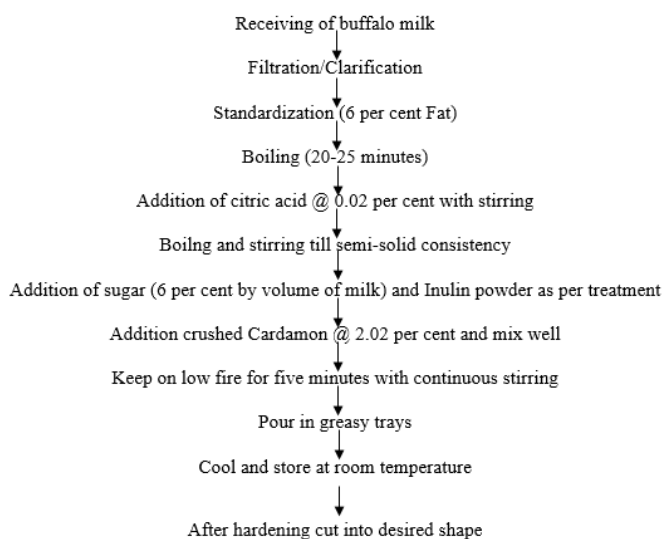


Fig 1: Flow-diagram for preparation of Kalakand blended with Inulin powder

Chemicals

The readymade edible inulin powder was procured from NATURES VELVET LIFECARE, 103, Liberty Plaza, Himayat nagar, Hyderabad – 500029, Telangana. The chemicals used in this study for chemical analysis and microbial study were of analytical grade.

Chemical Analysis

The Kalakand blended with inulin powder and without inulin powder (control) were chemically analyzed for moisture as per procedure described by IS: 1479 (Part-II) (1961) [8], fat by

IS: 1224 (Part-II) (1977) [7], protein as per the procedure described in IS: 1479 (Part-II) (1961) [8], ash by IS: 1479 (Part-II) (1961) [8], total solids estimated as per the procedure described in IS: 1479 (Part-II) (1961) [8], 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 Kalakand 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, Vasant Rao 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 determined by using standard procedure for Total Plate Count by method cited in IS: 5402 (1969) [10] using Nutrient Agar as Medium, Yeast and Mould count by method cited in IS: 5403 (1999) [11] using Potato Dextrose Agar as Medium and Coliform count by method cited in IS: 1479 (Part III, 1977) [9] using Violet Red Bile Agar (VRBA) as Medium.

Statistical analysis

All the data were expressed as mean \pm Standard error of mean calculated from four replications of experiment by using Completely Randomized Block Design (CRBD). One way analysis of variance (ANOVA) was applied to measure the test for significance as described by Steel and Torrie (1980) [18].

Results and Discussion

Effect of addition of inulin powder on chemical composition of Kalakand

The effect of different levels of inulin powder on chemical properties viz., moisture, fat, protein, total carbohydrates, ash, fiber and total solids of Kalakand was shown in Table 1. There was significant ($P < 0.05$) decrease in moisture, fat, protein and total carbohydrates content of Kalakand was observed with increasing the level of inulin powder. The control Kalakand had significantly ($P < 0.05$) higher moisture, fat, protein and total carbohydrates content than all experimental Kalakand samples. The decreasing moisture content could be due to utilization of water by inulin powder in gel formation. The results recorded in present investigation where comparable with Syed and Ghosh (2017) [20] reported that increasing level of inulin in processed cheese decreases moisture, fat, protein content of the processed cheese. Increased level of inulin powder in Kalakand results in significantly ($P < 0.05$) increasing the ash, fiber and Total solids content of Kalakand. The ash, fiber and total solid content of Kalakand blended with 2 per cent inulin powder were found highest. The findings of present study were similar with Suvera *et al.*, (2017) [19] reported that ash, fiber and total solids content in *shrikhand* increases with increase in addition of inulin.

Table 1: Effect of addition of inulin powder on chemical composition of Kalakand

Chemical Constituent	Treatment					CD ($P < 0.05$)
	T ₀	T ₁	T ₂	T ₃	T ₄	
Moisture	27.39 ± 0.018 ^a	27.09 ± 0.013 ^b	26.69 ± 0.018 ^c	26.29 ± 0.020 ^d	25.87 ± 0.016 ^e	0.0525
Fat	21.24 ± 0.017 ^a	20.95 ± 0.011 ^b	20.54 ± 0.010 ^c	20.25 ± 0.014 ^d	19.92 ± 0.011 ^e	0.0397
Protein	15.64 ± 0.012 ^a	15.34 ± 0.011 ^b	15.06 ± 0.013 ^c	14.71 ± 0.012 ^d	14.42 ± 0.014 ^e	0.0391
Total Carbohydrates	33.64 ± 0.034 ^a	33.36 ± 0.023 ^b	33.13 ± 0.027 ^c	32.71 ± 0.034 ^d	32.26 ± 0.008 ^e	0.0820
Ash	2.10 ± 0.012 ^a	2.19 ± 0.023 ^b	2.53 ± 0.017 ^c	2.72 ± 0.013 ^d	2.93 ± 0.014 ^e	0.0506
Fiber	0.00 ± 0.000 ^a	1.06 ± 0.013 ^b	2.07 ± 0.008 ^c	3.35 ± 0.010 ^d	4.59 ± 0.010 ^e	0.0293
Total Solids	72.61 ± 0.018 ^a	72.91 ± 0.014 ^b	73.31 ± 0.018 ^c	73.71 ± 0.020 ^d	74.13 ± 0.015 ^e	0.0528

Values are Mean ± Standard Error

Value with different superscript are significantly differed at $P < 0.05$

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

The effect of varying levels of inulin powder on sensory attributes viz., flavour, colour and appearance, body and texture, sweetness and overall acceptability of Kalakand was shown in Table 2. Inulin powder in Kalakand (T₃) secure significantly ($P < 0.05$) highest score for flavour as compare to other treatments. There was significant ($P < 0.05$) decrease in body and texture score. Highest score was recorded for T₀ whereas lowest for T₄. Significantly ($P < 0.05$) lowest score was obtained for T₄ in respect to color and appearance of *burfi* prepared with 2 per cent inulin powder. The color and appearance score was highest in control (T₀) Kalakand which

decrease with increasing the level of inulin powder with significant effect up to 2 per cent level. The sweetness score for Kalakand decreased from T₀ to T₄. Significant ($P < 0.05$) decrease in sweetness score was observed in T₂, T₃ and T₄ as compared to (T₀) control Kalakand. Significant ($P < 0.05$) increase in overall acceptability score was observed. Highest score for overall acceptability was obtained for T₀ as compared to other treatments of experimental Kalakand. The results were comparable to those of Suvera *et al.*, (2017) [19] reported non significantly decrease in flavour, colour and appearance, body and texture and overall acceptability score with increasing level of inulin in *shrikhand*.

Table 2: Effect of varying levels of inulin powder on sensory attributes of Kalakand

Treatment	Sensory Attributes				
	Flavour	Colour and Appearance	Body and Texture	Sweetness	Overall Acceptability
T ₀	8.16 ± 0.059 ^d	8.45 ± 0.030 ^a	8.86 ± 0.040 ^a	8.76 ± 0.037 ^a	8.55 ± 0.019 ^a
T ₁	8.39 ± 0.108 ^c	8.14 ± 0.046 ^b	8.62 ± 0.036 ^b	8.54 ± 0.042 ^b	8.42 ± 0.020 ^b
T ₂	8.59 ± 0.104 ^{ab}	7.86 ± 0.054 ^c	8.37 ± 0.044 ^c	8.26 ± 0.048 ^c	8.27 ± 0.023 ^c
T ₃	8.64 ± 0.050 ^a	7.59 ± 0.027 ^d	8.13 ± 0.040 ^d	8.01 ± 0.033 ^d	8.09 ± 0.018 ^d
T ₄	7.89 ± 0.070 ^e	7.41 ± 0.036 ^e	7.86 ± 0.053 ^e	7.76 ± 0.030 ^e	7.73 ± 0.010 ^e
CD $P < 0.05$	0.1235	0.1212	0.1308	0.1173	0.0569

Values are Mean ± Standard Error

Effect of addition of inulin powder on microbiological properties of Kalakand

The effect of varying levels of inulin powder on Total Plate Count, Yeast and Mould count, Coliform count) of Kalakand was shown in Table 3. The decreasing trend was observed in Total Plate Count. In respect of Total Plate Count significantly ($P < 0.05$) lowest count was observed for T₄ and highest score for control (T₀). Yeast and Mould count

decreased from T₀ to T₄. The Total Plate Count and Yeast and Mould count of Kalakand was decreased with decreasing the moisture content as the level of inulin powder increases in Kalakand. Coliform in any dairy product indicate the hygienic condition maintained during production and packaging. All the experimental Kalakand samples were free from coliform count. The results are in accordance with Tulavi *et al.*, (2018) [21].

Table 3: Effect of varying levels of inulin powder on microbiological properties of Kalakand

Treatment	Microbiological Properties	
	Total Plate Count cfu X 10 ³ / gm	Yeast and Mould Count cfu / gm
T ₀	11 ± 0.408 ^a	8 ± 0.408 ^a
T ₁	9 ± 0.408 ^b	6.5 ± 0.288 ^b
T ₂	8 ± 0.204 ^{bc}	5.25 ± 0.250 ^c
T ₃	7 ± 0.540 ^{cd}	4 ± 0.408 ^d
T ₄	5 ± 0.353 ^e	3 ± 0.577 ^{de}
CD $P < 0.05$	1.1994	1.2151

Conclusions

Inulin powder was added to Kalakand as a source of soluble fiber its addition upto 2 per cent significantly reduces the moisture, fat, protein, total carbohydrates whereas, ash, fiber and total solids content of Kalakand significantly increases. It also showed that control Kalakand scored highest score for all sensory attributes except flavour. Inulin powder in Kalakand

with 1.5 per cent secure highest score for flavour. Total Plate Count, Yeast and Mould count of Kalakand decreases towards higher level of incorporation of inulin powder. Thus, it can be concluded that inulin powder could be successfully incorporated in Kalakand up to 2 per cent without adversely affecting the sensory as well as nutritional quality of finished product.

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