



Research Paper

Process optimization for the production of paneer (soft cheese) kheer blended with Foxtail millet and Finger millet flour

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Received 21 June, 2014; Accepted 07 July, 2014 © The author(s) 2014. Published with open access at www.questjournals.org

ABSTRACT: In this study an attempt has been made to incorporate foxtail millet (*Setaria italica*) flour at 2, 3, and 4% levels in paneer kheer (heat desiccated sweetened milk product). Among these levels 2% blended product was found to be better sensory characteristics. Similarly, finger millet (*Eleusine coracana*) flour was blended at 0.5, 1.0 and 1.5% level to the paneer kheer mix and at 1% level incorporation awarded better sensory scores. Millets incorporated paneer kheer at optimized levels showed better texture and consistency and nutty flavour to the product. The foxtail and finger millet flour blended product was recorded significantly higher crude fiber content of 0.173 and 0.046% respectively.

Keywords: - Paneer kheer, foxtail millet, finger millet, crude fiber

I. INTRODUCTION

Major portion of the milk produced in the country is being utilized for the preparation of various indigenous dairy products like khoa and khoa (concentrated milk) based sweets, chhana and chhana (coagulated milk) based sweets, paneer, fermented milks etc. Traditional Indian products include several innovative blends used in the preparation of different variety of milk based delicacies. Among them Kheer (heat desiccated and sweetened milk) is one which is popular in the northwest, central and eastern part of India, and is popular as payasam in the southern part. Kheer is also a cereal based particulate dairy dessert is a unique product representing dairy and food processing going hand in hand. Conventionally it is prepared by partial dehydration of whole milk in a karhai over direct fire together with sugar and usually rice or semolina [1].

In recent years, cereals and its ingredients are accepted as functional food and nutraceuticals because of providing dietary fibre, proteins, energy, minerals, vitamins and antioxidants required for human health. Considering the constant health awareness of consumers towards the functional and healthy foods, the technology for cereal based products offer opportunities to fulfill the consumer acceptance.

Millets are the most digestible grains among the cereals and are good source of some important nutrients, including manganese, phosphorus and magnesium. In addition to the nutritional value of millets, they also provide many health benefits [2]. and also they provide protein, fatty acids, minerals, vitamins, dietary fibre and polyphenols [3]. The millets are source of antioxidants, such as phenol acids and glycosylated flavonoids [4]. Millet food are characterized to be potential prebiotic and can enhance the viability or functionality of probiotics with significant health benefits. The nutritional significance of millet demands for an examination of the nutritional characteristics and functional properties of different millet cultivars as well as developing value added products from millets [5].

The products based on millets could be particularly useful for people suffering from atherosclerosis and diabetic heart disease. An attempt, therefore, was made to manufacture paneer kheer like products blending with foxtail millet and finger millet.

II. MATERIALS AND METHODS

Milk: Fresh cow milk was procured from the student's experimental dairy plant (SEDP) Dairy Science College Bangalore and milk is standardized to 3.5% fat and 8.5% MSNF. **Sugar:** Good quality cane sugar was procured from the local market. **Millets:** Food grade Foxtail millet and Finger millet were purchased from dealers. **Paneer:** Paneer was prepared by following the procedure as per [6] with slight modifications. The

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standard cow's milk is heated to 90°C/hold, and then cooled to 70°C. The hot 2 per cent citric acid solution is added to milk with vigorous stirring initially then gently stirring later till the completion of coagulation. Then coagulant added milk was left for 5 minutes without disturbing. Afterwards the clear whey was separated through muslin cloth and collected paneer curd was kept for pressing for 30 minutes and then dipped in chilled water for 1-2 hours and paneer was used for preparation of millet blended paneer kheer.

Method of manufacture of Paneer kheer: Paneer kheer was prepared by following the procedure as per [7] with slight modifications. The procedure involves boiling the milk (1 liter) and reduces it to one-half of its original volume. Add sugar (40 g) to it and boil further till its original volume is reduced to one-third. Then add the pieces of paneer (150 g) and continue heating gently until the sugar has penetrated in to paneer cubes.

Preparation of millet flour: Millet flour was prepared using the mixer grinder. The pre-cleaned millets were made in to powder form by grinding in mixer and to get fine powdered flour was sieved by using ISI marked mesh.

Analytical procedure: Analysis of milk: The fat content was determined by Gerber method. **Analysis of millets blended paneer kheer: Chemical analysis: Total solids** Total solids of samples were estimated by gravimetric method as per [8]. Crude fiber, Ash, Fat and protein: Ash, Fat and protein per cent in samples were determined as per [8]. Physico-chemical Characteristics :pH: The pH of millets blended paneer kheer samples was determined using a microprocessor digital pH meter (Elder make). **Water activity:** Water activity of samples was measured using water activity meter (Rotonic Ag Company) at 23±0.2°C. **Penetration:** Penetration of kheer samples were measured by using cone penetrometer (Associated Instrument Manufactures PVT (I) LTD): **Blending of millet flour in paneer kheer :** For the preparation of paneer kheer following blends of foxtail millet and finger millet flour were studied. T₀ = paneer kheer: T₁ = paneer kheer + 2% foxtail millet flour.:T₂ = paneer kheer + 3% foxtail millet flour: T₃ = paneer kheer + 4% foxtail millet flour: T₄ = paneer kheer + 0.5% finger millet flour: T₅ = paneer kheer + 1% finger millet flour:T₆ = paneer kheer + 1.5% finger millet flour: All treatments along with control were replicated with three times. The paneer kheer was prepared following the process and specification as shown in Fig 1. The sensory evaluation of various products was done using nine point "Hedonic scale" developed by Quarter master of Food and Container Institute and recommended by [9] for food and dairy products.

III. RESULTS AND DISCUSSION

The present study has been undertaken to optimize the blending of various levels of millet flour to get the best sensory characteristics of millets blended paneer kheer.

Sensory characteristics of Foxtail millet blended paneer kheer. Table 1: There was no statistical significant difference ($P \leq 0.05$) in colour and appearance scores of control and 2 per cent blended foxtail millet flour. Whereas, at 3 and 4% level of incorporation product awarded significantly lower score for colour and appearance due to dull and slightly dark in appearance. The sample prepared by using millet at 2% level awarded maximum body and consistency score of 8.45 compared to control (7.80) and 3% (7.52) and 4% (7.27) level incorporated millets. It is revealed from the data that the flavour score of 2% millets blended flour product was found to be significantly superior over that of control and other treated samples. Addition of foxtail millet at 2 per cent level was found to be optimum taste of foxtail millet blended product with nutty flavour. At higher level of incorporation of foxtail millet i.e. at 3% and 4% level incorporated samples imparts powdery flavour to the product. Therefore behind 2% level of millets incorporated products are awarded significantly lower flavour scores. The product prepared by blending foxtail millet at 2% level were awarded better sensory score this in turn reflects the better overall acceptability score of 8.49, which was significantly better than all the samples. These findings are almost associated with the reports of [10] that the foxtail millet is tasty and sweet nutty like flavour and contains nutritional benefits. Similar result was reported by [11] that the kheer has creamish colour as well as sweet nutty and cooked flavour due to prolonged cooking.

Sensory characteristics of Finger millet blended paneer kheer. Table 2: There was no statistical significant difference ($P \leq 0.05$) in colour and appearance scores of the product prepared by blending finger millets at 0.5 and 1.0% level treated samples but at 1.5% level product showed the significantly lower score of colour and appearance due to dark and dull appearance. The sample prepared by blending millet at 1% level was awarded maximum body and consistency score of 8.48 compared to control and other samples. Addition of finger millet flour level at 1 per cent was found to be optimum because it gives ideal smooth viscous texture and consistency to the product. [12] Reported on aroma-sweetness interactions on dairy desserts were found to be the soft in texture. The better body and consistency of finger millet based product was due to the presence of resistant starch as reported by [13]. [14] and [15]. Also reported that the improvement in texture of product blended with finger millets. At higher level of finger millet flour product was found to be thick and viscous. Similarly product with 1% finger millet blended product was awarded with maximum flavour score of 8.65 compared to other samples. This could be due to the improvement in the nutty and fruit flavour. But at 1.5 %

levels judges felt the raw powdery taste. [16] Reported that the fortification of finger millet in food not only improve the taste but also helpful in controlling glucose level in diabetic patients very effectively. Because of better sensory characteristics of the sample prepared by blending of finger millet at 1% level awarded better overall acceptability score. [17] Reported that the pleasant cooked nutty or fruity flavour were observed in preparation of payasam. [18] Reported that the successful utilization of finger millet in the preparation of value added products will give good sensory quality.

Chemical composition of standardized millets blended paneer kheer: Chemical composition of paneer kheer prepared from optimized levels of Foxtail millet flour and Finger millet flour blend paneer kheer was presented in Table 3. Observation recorded revealed that the total solids, protein, fat, ash contents were slightly higher in millets blended products. Whereas, crude fiber contents was noticed in millets blended samples but not in the control sample. The crude fiber contents of foxtail and finger millet blended sample showed the significantly higher content of 0.173 and 0.046% respectively.

Physico-chemical properties of standardized millets blended paneer kheer. Table 4: It can be observed from the table that addition of millets flour has significantly difference in penetration values were observed compared to control. Whereas, there was no significant effect on the pH of treated samples. But in case of water activity (a_w) the foxtail millet flour and finger millet flour blended product recorded significantly lower water activity.

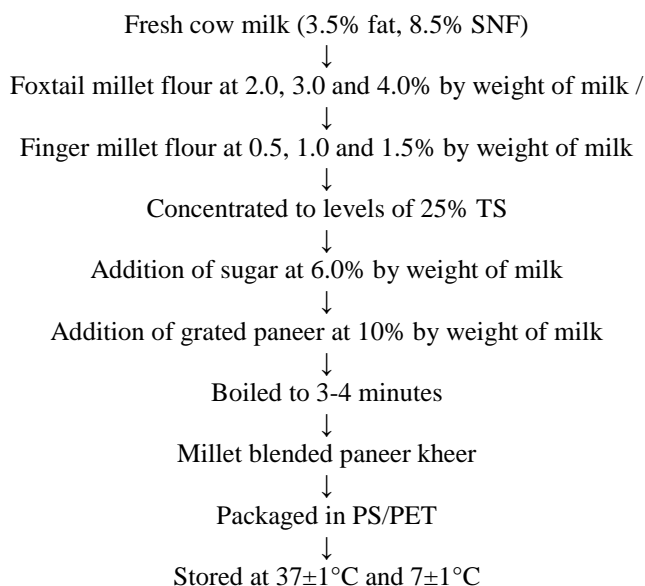


Figure.1 Flow diagram for preparation of millets blended paneer kheer

Table 1 Effect of different levels of Foxtail millet flour on the sensory characteristics of

| Level of Foxtail millet flour (%) | Colour & Appearance | Body and consistency | Flavour | Overall acceptability |
|-----------------------------------|---------------------|----------------------|-------------------|-----------------------|
| T ₀ | 8.33 ^a | 7.80 ^a | 8.00 ^a | 7.88 ^a |
| T ₁ | 8.25 ^a | 8.45 ^b | 8.64 ^b | 8.49 ^b |
| T ₂ | 7.50 ^b | 7.52 ^c | 7.29 ^c | 7.62 ^c |
| T ₃ | 7.29 ^b | 7.27 ^c | 6.65 ^d | 7.00 ^d |
| CD (P≤0.05) | 0.706 | 0.647 | 0.621 | 0.605 |

Table 2 Effect of different levels of Finger millet flour on the sensory characteristics of Paneer kheer

| Level of Finger millet flour (%) | Colour & Appearance | Body and consistency | Flavour | Overall acceptability |
|----------------------------------|---------------------|----------------------|-------------------|-----------------------|
| T ₀ | 8.16 ^a | 7.95 ^a | 7.87 ^a | 7.89 ^a |
| T ₄ | 8.12 ^a | 8.00 ^a | 8.12 ^a | 7.91 ^a |
| T ₅ | 8.08 ^a | 8.48 ^b | 8.65 ^b | 8.40 ^b |
| T ₆ | 7.29 ^b | 6.79 ^c | 6.37 ^c | 6.70 ^c |
| CD (P≤0.05) | 0.502 | 0.474 | 0.524 | 0.433 |

Table 3 Chemical composition of standardized millets blended paneer kheer

| Components (%) | Control | Foxtail millet at 2 % level | Finger millet at 1% level | CD (P≤0.05) |
|----------------|--------------------|-----------------------------|---------------------------|-------------|
| TS | 35.86 ^a | 37.28 ^a | 35.95 ^a | 3.138 |
| Protein | 6.70 ^a | 6.82 ^a | 6.71 ^a | 2.544 |
| Fat | 7.58 ^a | 7.49 ^a | 7.50 ^a | 0.624 |
| Ash | 1.19 ^a | 1.25 ^a | 1.22 ^a | 0.174 |
| Crude fiber | 0.00 ^a | 0.173 ^c | 0.046 ^b | 0.0159 |

Table 4 Physico-chemical properties of standardized millets blended paneer kheer

| Properties (%) | Control | Foxtail millet at 2 % level | Finger millet at 1% level | CD (P≤0.05) |
|----------------------------------|--------------------|-----------------------------|---------------------------|-------------|
| Penetration (m/m for 5sec.) | 10.0 ^a | 8.00 ^c | 9.00 ^b | 0.00 |
| pH | 5.93 ^a | 5.99 ^a | 5.96 ^a | 2.229 |
| Water activity (a _w) | 0.928 ^a | 0.909 ^b | 0.913 ^b | 0.0129 |

IV. CONCLUSION

The consumption of concentrated milk based products is increasing in recent years, mainly due to its excellent nutritional and sensory characteristics. Concentration of milk imparts sweet nutty flavour to the milk further incorporation of paneer in to the product enhance the nutritional and taste to the paneer kheer. Further blending of foxtail millet at 2% (or) finger millet at 1% along with paneer enriches the product with dietary fibre, proteins, energy, minerals, vitamins and antioxidants required for human health. Considering the constant health awareness of consumers towards the functional and healthy foods, the technology for cereal based products offer opportunities to fulfill the consumer acceptance. In this context development of paneer kheer with millets blending is definitely attracts the consumers throughout the country. Such, developed products has high market potential for commercialization. Further, different millet and cereals based dairy products can be studied.

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