PROCESS OPTIMIZATION AND SHELF LIFE STUDY OF TURMERIC BLENDED MILK

1J.J. Jankar, 2V.N. Nagargoje, 3A.K. Sahoo, 4S. M. Lokhande
Department Of Technology, Shivaji University, Kolhapur 416 004 (M.S) India
E-mail: jankjagruti@gmail.com

ABSTRACT: Process optimization and shelf life study of turmeric blended milk, was investigated. Organoleptic performances of milk with the addition of 0.2% curcumin, 7% fresh turmeric rhizomes extract and 2 % turmeric powder., were tested by panellists, and the total bacteria, ph and acidities, were detected by total plate counts respectively. The main objective of the current study is to formulate a ready-to-drink beverage incorporate with milk and turmeric extract, turmeric powder and curcumin form are in a great demand in the Aurveda and Aurveda market and it was pasteurized processed in glass bottle. The plant material turmeric (roots) contain aromatic compounds inhibit the growth and enzymatic activities of the bacteria within the stored milk. Turmeric has a wide range of health benefits and medicinal uses. Main compound in turmeric is curcumin which acts as anti-oxidant and anti-inflammatory, making it a promising complementary therapy for cancer-prevention. Shelf life study revealed that the ph values decreased from (6.66 to 6.44 and 6.66 to 6.42), the acidity (0.15–0.25) increases. To reduce the spoilage of the milk aromatic supplements can be added. Product was superior in all sensory attributes which is a normal physico-chemical change but all the flavoured milks were microbiologically safe. Turmeric based flavored milk enhances flavor, medicinal properties and nutritional value of milk.

INDEX TERMS: Milk, Turmeric, Turmeric Blended Milk, Dairy products, Milk beverages and flavored milk

1. INTRODUCTION

Milk with more than 200 ingredients of functional and nutritional properties, is an essential part of human diet. Milk production in India involves millions of small producers with little or no land, each of them raising one or two low yielding, non-descript cows or buffaloes. Presently, more than 77000 village dairy co-operatives societies have been opened up in India, where more than 10.4 million farmers are members. From the point of milking to the dairy, there are milk losses during milking, handling, transportation, processing etc. Farmers are getting less value for money due to losses in handling and processing of milk and indulge into adulteration of milk. Hence, there is a need to develop processing methods to add value, increase shelf life and increase farmer’s income. For this purpose, small scale processing and packaging machines, relevant in rural areas, will have to be developed (Chatterjee et al., 1992). Pasteurized processed foods only eliminate the need for refrigeration. The primary function of glass bottle is to give good heat seals and product resistance and contributes to the strength of packaging materials (Gopal et al., 2001). The products are dairy dessert dali (Jha et al., 2012), dairy dessert kheer (Jha et al., 2011) and retort sterilized dairy beverages. The flavoured milk is prepared by addition of different flavours e.g. Vanilla, chocolate, cardamom, coffee, rose or any other edible flavor, edible food colours and sugar to the milk. Flavoured milk industry is having huge market potential as it is a regular drink for refreshment in India and also offers the farmers the option of increasing their income. Flavoured milk should be pasteurized, sterilized or boiled (Srivastava, 2010). Due to the higher market potential of processed milk beverages with longer shelf life, the present work was undertaken with the following objectives: to develop a commercial process for manufacture of turmeric blended milk drink compared to conventional in bottle sterilized product with poor consumer appeal, to find out the changes in physical, chemical, microbiological and nutrient quality of turmeric blended milk beverages and study the storage life of turmeric blended milk beverages.

The spoilage of pasteurized milk may result in microbial and chemical changes in the milk (Reinheimer et al., 1993). The biochemical changes of the milk at spoilage may have resulted from the activities of extracellular enzymes, especially protease, which degrades protein (Deeth et al., 2002; Janzen et al., 1982); and lipase, which degrades lipid (Deeth et al., 2002; Bucky et al., 1986). The addition of antibacterial and aromatic supplements, to reduce the spoilage, can be added to the milk. It is widely known that there are a lot of commercial antibacterial and aromatic plant materials produced in Indonesia, such as: honey, cinnamon, citronella (sweet), ginger, radish, turmeric, galangale, zingiber (roots), wild ginger, nutmeg, cardamom, cumin, pepper (seeds), garlic, clove, javanoni, galangale (bubs); green tea, laurel like (dried leaves); bamboo leaf, banana leaf, guava leaf, avocado leaf, betel vine, celery, garlic leaf, aloe vera (fresh leaves). These twenty-seven plant materials contain antibacterial and aromatic compounds, which may inhibit the growth and enzymatic activities of the psychrotrophic bacteria within the stored milk.

II. MATERIALS AND METHODS

2.1 Procurement of raw material

The study was conducted at the milk Processing Laboratories of the Department of Technology, Shivaji University, Kolhapur. For the preparation of turmeric blended milk, buffalo milk was collected from Dairy Farm, College of Agriculture, Kolhapur (Maharashtra).Turmeric rhizome powder of three different varieties namely Salem, Pratibba and Rajapuri were collected from a reliable source of Kolhapur (Maharashtra).Glass bottle was used for pacakaging of samples during storage study.
Experimental procedure

**Preparation of Turmeric Blended Milk**

Turmeric blended milk was prepared according to the procedure described by Dalim *et al.*, (2012) using cow and buffalo milk.

1. **Reception of milk**
2. **Pre-heating (35-40°C)**
3. **Filtration**
4. **Separation (cream separator machine)**
5. **Standardization (1.5 % milk fat)**
6. **Heating (65 to 70ºC)**
7. **Addition of sugar**
8. **Addition of turmeric powder (40 to 42ºC)**
9. **Homogenization (2000 and 500 PSI)**
10. **Bottle filling and capping**
11. **Bottle pasteurization (75-78ºC for 5 min)**
12. **Cooling and Storage (5 ±2ºC)**

*Fig. 1* Process flowchart for manufacturing of turmeric powder blended milk

**2.2 Standardization of Turmeric Blended Milk**

Double toned milk was processed at three different proportions of turmeric extract concentration, turmeric powder concentration, curcumin concentration and sugar. The best adjudged process parameter was used for subsequent trails. Then the level of incorporation of turmeric extract (3%, 5% and 7%), turmeric powder (1%, 2% and 3%) and curcumin (0.2%, 0.4% and 0.6%) was optimized. The product which commanded highest sensory acceptance was further storage study for a period of seven days.

**2.3 Storage Study**

**2.3.1 Pasteurized Processing of Turmeric blended Milk**

The standardized turmeric milk with highest sensory acceptance from these trails was processed in transparent glass bottle was studied for heat penetration characteristics. The turmeric blended milk was prepared packed in transparent glass bottle was processed in an over 5ºC temperature.

**2.3.2 Physico Chemical and Sensory Evaluation**

Acidity, pH, Specific gravity of the processed samples were analyzed by the method of AOAC (2005). Colour of the sample was tested using Hunter lab Mini scan XE plus calorimeter (Model No. 450-0-L, Reston Virginia, USA) with geometry of diffuse 8/0 (sphere - 8mm view) and an illuminant of D-6511 (Bbindu *et al*., 2007). Sensory analysis of turmeric blended milk was done by 12- non trained panelists using 9 point hedonic scales. The panelists were asked to score for colour, flavor and overall acceptability for the samples. The sample T2 recorded highest score in all sensory properties and found to be overall acceptable over the sample T1 and T3.

**2.4 Microbiological Testing**

**2.4.1. Standard Plate Count**

Procedure: Cleaning, sterilization, preparation of media, pouring of plates. Standard plate Count (SPC) procedure was used to determine the number of microorganisms in the sample. It is an agar plate method for estimating population of bacteria. The serial dilution (10-3) of the fresh sample was prepared. 1ml of each dilution was transferred so sterilized Petri plate, 10ml of the sterilized melted cooled agar medium was added to each plate and each plate was rotated gently, immediately after addition of the medium for uniform distribution of the organisms and the agar was allowed to solidify.

**3.4.2. Yeast and Mold count**

Procedure: Pipette 1 ml of sample of dilution which has been selected for plating into a petridish in duplicate. Acidify PDA or malt agar with sterile 10% tartaric acid to pH 3.5. Do not re heat medium once acid has been added. Pour 10-12 ml of the agar medium (tempered to 45ºC) mix by swirling & allow solidifying. Incubate at 20 to 25 ºC for 2 to 5 to 7 days. Discard the plate after seven days if growth is not observed. Count colonies, multiply by the inverse of the corresponding dilution and report as yeast and mold count per gm or ml.
III. RESULT AND DISCUSSION

The turmeric blended milk samples were stored at 4-6°C and evaluated rheologically and organoleptically at 0, 1, 2, 3, 4, 5 and 6 days of refrigerated storage respectively.

3.1 Physico-Chemical Properties of buffalo milk, Turmeric Extract, Turmeric Powder

The physico-chemical analyses of buffalo milk average water, protein, fat and total solids (TSS) of 84.02%, 4.37 %, 8.1 % and 17.98 % respectively, the fat per cent ranges from 7.8 to 8.4. The average acidity and pH of buffalo milk was 0.15 percent and 6.5. Turmeric rhizomes of three different varieties namely Salem, Pratibha and Rajapur ranges from yellowish brown to deep brown in colour. The variation in colour was due to difference in curcumin content. The rhizome length and breadth ranged from 7.90 to 9.85 and 2.82 to 2.89 cm respectively thickness ranged from 2.62 to 2.77 cm. Chemical characteristics fresh turmeric rhizomes revealed that moisture content was found to be highest in Rajapur (88.6 per cent) followed by Salem (88.4 per cent) and Pratibha (80.9 per cent). The carbohydrate content in Pratibha variety was found to be 13.65 followed by Salem (8.55per cent) and in Rajapur (8.44 per cent) variety respectively. Protein and fat content in Pratibha variety was found to be more as compare to Salem and Rajapur. Pratibha variety was found to be significantly superior in carbohydrates and protein content over the Salem and Rajapur varieties. The TSS of fresh turmeric rhizomes was found to be 100 Brix in Pratibha variety followed by 92 Brix and 89 Brix in Salem and Rajapur variety respectively. The most important proximate component of fresh turmeric rhizome was of its curcumin content with respect to processing and preparation of value added products. Chemical characteristics of fresh turmeric powder revealed that moisture content was found (6.2 %) and ash (6.0%) and carbohydrate content in turmeric powder was found (69.08%).

3.2 Preliminary Trails for Standardization of Turmeric Blended Milk

The preliminary study was carried out by processing the double toned milk in non transparent glass bottle at different concentration of turmeric powder (2, 4, 6 % respectively). The results of sensory analysis shown that the range of acceptability was found to be good for the milk processed at the concentration 2%. Milk processed at concentration of 6 gave rise to uncharacteristic taste and was rejected by panelist. Subsequently, the standardization with different concentration of turmeric blended milk was carried out. The sensory study shown that the processed turmeric blended milk with 2 % turmeric had better sensory acceptability.

3.3 Physico-chemical changes during storage

During storage study different parameters like pH, acidity, specific gravity and instrumental colour measurements were studied at regular interval of 2 days once for a period of 6 days. The change in pH and acidity value for the turmeric blended milk in transparent glass bottle is shown in Table 1.

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<th>Table 1: Change in pH and acidity during storage of turmeric blended milk</th>
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It was observed that pH of the turmeric blended milk showed a decreasing trend on storage in glass bottle. The result of the pH is similar to the observation made by (Tekinsen et al., 2007). Storage temperature and time have a great effect on pH and acidity. Increase in acidity might be due to increase in concentration of lactic acid and other organic acids which resulted from degradation of lactose. Acidity of turmeric blended milk in glass bottle increased slightly during storage shown in table 1.

3.4 Microbial study

All the samples were tested for commercial sterility and all of them are commercially sterile. In the microbial parameters viz. total viable count, coliform, yeast and mould for all three turmeric blended milk in glass bottle packaging were studied and they were absent on ‘0’ day and as well as on ‘06’ day of storage. Similar results were observed for UHT processed milk during 12 months storage period (Hassan et al., 2009).

3.5 Safety Analysis

It consists of both chemical and microbial analysis to ensure the safety of the product.

3.5.1. Chemical Testing

Here, in this section acidity and pH value is evaluated and analyzed.

3.4.1.1. Acidity

Procedure: Determination of Acidity percentage was determined by titrating with N/10 sodium hydroxide solution.
Sensory evaluation of turmeric blended milk in glass bottle was carried out at regular intervals of one day by 9 point hedonic scale (Table 8). The results of the study showed that overall acceptability of turmeric rhizome extract blended milk packed glass bottle were very good, with 8.27 initially. However, at the end of the storage period (07 days) the acceptability of glass bottle packed products reduced to 7.05 and 7.08 respectively under ambient storage conditions. Among other characteristics, colour had a minimum score of higher score of 8.24 and 8.2 initially and the same is reduced to 7.04 and 7.08 after 06 days of storage. No leakage, off odour or any other spoilage was noticed in the glass bottle during 06 days of storage period.

**Fig. 1: Effect of fresh turmeric rhizomes extracts concentration**

The sample containing 5 per cent turmeric extract was extremely liked for its taste attribute with highest score value for sample T2 (8.20) followed by sample T3 (8.0) and T1 (7.9) respectively.

**Fig. 2: Effect of turmeric powder concentration**

The results in fig. 2 revealed that the sample T5 recorded highest score in all sensory properties and found to be overall acceptable over the sample T4 and T6. However, sample T6 was also found to be significant over the sample T4 which retains lowest score in all sensory properties. The taste of turmeric milk was influenced by the addition of sugar. The sample containing 2 per cent turmeric powder was extremely liked for its taste attribute with highest score value for sample T5 (8.30) followed by sample T3 (8.0) and T1 (7.4) respectively. The sample T5 scored highest for textural properties while it was just par with sample T6 and sample T4 scored (7.4).

**Fig. 3: Effect of curcumin proportion concentration**

The sample containing 0.2 per cent curcumin was liked for its taste attribute with highest score value for sample T7 (8.20) followed by sample T8 (7.9) and T9 (7.6) respectively.
The results in fig. 3 revealed that the sample T7 recorded highest score in all sensory properties and found to be overall acceptable over the sample T8 and T9. However, sample T9 was also found to be significant over the sample T8 which retains lowest score in all sensory properties.

The taste of turmeric milk was influenced by the addition of sugar. The sample containing 0.2 per cent curcumin was extremely liked for its taste attribute with highest score value for sample T7 (8.0) followed by sample T9 (7.7) and T8 (7.3). The milk containing 0.2 per cent curcumin proportion was found to be overall acceptable and liked by all sensory semi trained panel members. However sample T9 containing 0.6 g curcumin was not much liked by panelists as it gives more sweet taste and pungent taste.

REFERENCES