DEVELOPMENT AND EVALUATION OF GINGER FLAVORED HERBAL MILK

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ABSTRACT: The preparation of Ginger Flavoured herbal milk by addition of ginger extract with milk and investigating the proximate quality, textural characteristics, keeping quality and sensory attributes of the developed product. Laboratory analysis carried out to study the variation in moisture, protein, fat ash content, pH, Acidity and Specific Gravity. Slight changes were observed compared to normal milk. The organoleptic studies appearance, colour, flavor, taste and overall acceptability were studied and overall acceptability was observed to be good. Microbial studies like total plate count (TPC), yeast and mould count, coliform and E.coli count were carried out to evaluate the safety and keeping quality of the products. Antioxidant and iron chelating activity of the ginger flavored herbal Milk was determined. Overall acceptability of the ginger flavoured herbal Milk was found to be good and recommended for market exploration.

Key words: Herbal Milk, Ginger extract, organoleptic studies, Antioxidant Properties, Microbial studies.

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INTRODUCTION
Flavoured milk is a delicious, nutritious, healthy and relatively inexpensive thirst quenching drink consumed by all categories of people. More and more people are adopting herbal way of life for their health benefits. There is also a need to find diverse technologies to add value to milk and its by-products [1]. Ginger (Zingiber officinale Roscoe) is one of the world’s best-known spices, and it is universally used throughout history for its health benefits. The main antioxidant principles in ginger are the gingerols, shogaols and some related phenolic ketone derivatives. Ginger is one of the significant medicinal plants used in ancient Indian Medicine. It is found effective internally, when used in food preparation and herbal extracts and externally as a ginger compress or mixed with oil to massage around the joints [2]. The pungent constituents of ginger are the gingerols, an oily liquid consisting of homologous phenols. It is formed in the plant from phenylalanine, malonate and hexonate [3]. Fresh ginger contains 80.9% moisture, 2.3% protein, 0.9% fat, 1.2% minerals, 2.4% fibre and 12.3% Carbohydrates. The minerals present in ginger are iron, calcium and phosphorous. It also contains vitamins such as thiamine, riboflavin, niacin and vitamin C.
The composition varies with the type, variety, agronomic conditions, curing methods, drying and storage conditions [4]. The ginger bears an enormous number of pharmacological activities such as Cardio protective activity, Anti-inflammatory activity, Anti-microbial activity, Antioxidant property, Anti-proliferative activity, Neuro-protective activity and Hepatoprotective activities which have been proved [5-8].

MATERIALS AND METHODS
Toned milk of Standard Company, Good quality cane sugar and aqueous ginger extract were used as raw materials in the study.

Preparation of Aqueous Ginger Extract
The fresh ginger rhizomes were washed, peeled, sliced and sun dried for seven days. After drying ginger slices were ground to fine powder separately using electric blender. 20 g powder of ginger was soaked in 100 ml of distilled water. The flask was incubated at room temperature for 72 hours with shaking at 120 rpm. The crude extract was centrifuged at 3000 rpm for 10 minutes at 25°C. The extract was evaporated at 50°C while the aqueous extracts were evaporated at 80°C in rotary evaporator. All dried extract samples were dissolved in distilled water separately to the final concentration of 100 mg/ml and centrifuged again at 10,000 rpm to remove the undissolved residues. The extract solutions were stored at 4°C [9].

Preparation of Ginger flavored Herbal milk
For the preparation of Ginger herbal flavoured Herbal milk, the procedure given by De (1980) was followed [10]. Trials were conducted to assess the level of addition of Ginger extract to prepare herbal flavoured milk. Among different concentrations 10% extract was found to be ideal for herbal flavoured milk preparation based on sensory evaluation and the samples were homogenized, sweetened with 5% cane sugar, filled in to 250ml sterilized glass bottles, pasteurized at 161°F for 16 minutes and cooled and stored in refrigerator (5-10°C). All the samples were analyzed for various chemical parameters such as pH, acidity, TSS, protein and fat content and organoleptically evaluated for color and flavor at fresh and after one week for a total period of 60 days at 5-10°C. The data regarding each parameter are presented in tables, statistically analyzed and discussed as under:

Analytical work
The freshly prepared Ginger flavored Herbal milk was analyzed for pH, total soluble solids, titratable acidity, crude protein and crude fats during storage to see the effect of storage on its chemical composition. pH was determined with the help of pH meter. The total soluble solids were determined by the standard method of A.O.A.C (1984) using hand refractometer at room temperature. Total acidity was determined by standard method of A.O.A.C (1984). Protein percentage of the Ginger flavored milk was estimated by the Babcock as recommended by A.O.A.C (1984). Lactose content was determined by using Fehling’s solution method (Triebold, 2000). The ash content was obtained by incineration of the sample placed in the muffle furnace at 550 °C for 6 h (AOAC, 2000). For minerals analysis, the milk solid contents were taken and digested using two volumes of concentrated nitric acid. After adding one volume of perchloric acid, the contents were heated gently on a hot plate followed by a vigorous heating till dryness. This digestion technique makes no attempt to dissolve any silicate-based material that may be present in the samples. After cooling, the digested samples were quantitatively transferred to a flask and diluted to 100 ml with deionized double distilled water and then filtered. Atomic absorption spectrophotometer equipped with standard burner, air-acetylene flame and hollow cathode lamps, as radiation source, was used for the analysis of minerals [11].

Sedimentation
To make this measurement a fixed volume of milk and filter through a screen made of lintine paper which has been mounted in the base of a large funnel. The filter1 is held in place by a bushing and by the funnel being tightened into place with a ¼ turn. The bushing used to test liquid milk is a set of two plastic rings: one serves as a bottom washer and the other ring comes with a small hole (aperature) in the center. The filter / filter card is held in place between these 2 rings. The size of the aperature is determined by the volume of milk that will be tested: 1, 2, 4 or 16 oz. The filter can be a simple disc of lintine paper or it can be a disc mounted in a card (Sediment Tester Card) that allows you to record all the necessary information for that milk sample and provides a convenient storage for your records [12].

Organoleptic evaluation of the Ginger Flavored Herbal Milk by QDA Method
QDA may be used to completely describe the sensory sensations associated with a product from Initial visual assessment to afternote taste, or the anelists may be instructed to focus on a narrow range of attributes such as texture descriptors. During QDA sessions, 10-12 judges are exosed to many ossible variations of the product to facilitate accurate concept formation.
The product evaluations are performed by each judge individually, usually while seated in isolated booths. The resulting data can be analyzed statistically using analysis of Variance and Multi Variate statistical Techniques [13].

**Microbiological evaluation of the Ginger Flavored Herbal Milk**

Microbiological studies were conducted at every seven days of storage. Total plate count (TPC), yeast and mould count, coliform and E.Coli were undertaken. The procedure of Cruick Shank et.al, (1975) was used for total plate count and yeast and mould count.

**Shelf life study of ginger flavored herbal milk**

The prepared Herbal milk was stored cold storage (5-10°C) to study the shelf life. The Herbal Milk developed was assessed every month. The qualities considered during the study were Organoleptic, Physico chemical and Microbiological.

**Anti oxidant activity of Ginger flavored herbal milk Scavenging of 1,1-diphenyl-2-picrylhydrazyl (DPPH) free radical**

The scavenging of DPPH free radical of the samples was measured using the method of McCue and Shetty with some modifications. A 0.1 mM DPPH radical solution in ethanol was prepared. 8ml of ethanolic DPPH solution was mixed with 2ml of sample or ethanol (as control), vortexed well, and then incubated for 30 min at room temperature. The samples were then centrifuged for 10 min at 9500 rpm at room temperature. After filtration through a Whatman No 40 filter, absorbance of each sample at 517 nm was measured. Trolox at a concentration of 0.25 mg/ml was used for comparison. Radical-scavenging activity was calculated as follows:

\[
\text{DPPH radical-scavenging activity (\%)} = \frac{(\text{absorbance of control- absorbance of sample})}{(\text{absorbance of control})} \times 100
\]

**Chelation of metal ions (Fe2+)**

Sample extracts were prepared according to Hernández-Ledesma et al. The chelating activity of samples on Fe2+ was measured according to El and Karakaya with some modifications. Briefly, one millilitre of sample (1 g/ml) was mixed with 3.7 ml deionized water. Each sample was incubated with 0.1 ml FeCl24H2O (2 mM) for 40 min. After incubation, the reaction was initiated by addition of 0.2 ml ferrozine (5 mM). The mixture was shaken vigorously and left at room temperature for 10 min. The absorbance of the mixture (formation of the ferrous iron-ferrozine complex) was measured at 562 nm. The control was performed in the same way using FeCl24H2O and water. The lower the absorbance of the reaction mixture means the higher the Fe2+ chelating ability. EDTA (0.1 mg/ml) was also run in the same way for comparison. The chelating activity was calculated using the following equation.

\[
\text{Fe2+ chelating activity (\%)} = \left[ 1 - \frac{(\text{absorbance of sample / absorbance of control})}{1} \right] \times 100
\]

**STATISTICAL ANALYSIS**

The data were analyzed using univariate and multivariate statistical analysis. Analysis of Variance (ANOVA, proc mixed, SAS version 8.2, 2001) was performed to determine significant effects of the attribute intensities in each of the products. A significant F-ratio (\(\alpha < 0.05\)) from the ANOVA indicated that an attribute was used to find differences among the products. Multivariate Analysis of Variance (MANOVA) was used to determine differences among the products, expressed in terms of mean vectors of the sensory attributes. Descriptive Discriminant Analysis (DDA, proc candisc SAS version 8.2, 2001) was applied to identify sensory attributes that essentially emphasized differences among the products. When applying this technique, canonical coefficients are calculated.

**RESULTS AND DISCUSSION**

**Ginger Flavored Herbal Milk**

Ginger Flavored Herbal Milk was developed at laboratory level and stability of the product was evaluated. The results were subjected to appropriate statistical analyses.

**Physico –chemical characteristics of Ginger Flavored Herbal Milk**

The physical characteristics such as moisture, total solids, specific gravity, pH, conductivity, viscosity and titratable acidity are important parameters in studying the physicochemical compositions and nutritional aspects of milk. Table 1 shows the various physical parameters of the Ginger Flavored Herbal Milk. The initial values of the product before storage are presented in the table1.
Table 1: Physico-chemical properties of Ginger Flavored Herbal milk

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Observed Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>6.65±0.012</td>
</tr>
<tr>
<td>Acidity</td>
<td>0.15±0.004</td>
</tr>
<tr>
<td>Specific gravity</td>
<td>1.078±0.02</td>
</tr>
<tr>
<td>Fat (%)</td>
<td>2.05±0.007</td>
</tr>
<tr>
<td>Protein (%)</td>
<td>3.48±0.017</td>
</tr>
<tr>
<td>Lactose (%)</td>
<td>4.54±0.022</td>
</tr>
<tr>
<td>Total solids (%)</td>
<td>17.57±0.032</td>
</tr>
<tr>
<td>Total ash (%)</td>
<td>0.67±0.004</td>
</tr>
<tr>
<td>Sedimentation (mg)</td>
<td>0.6</td>
</tr>
</tbody>
</table>

Organoleptic evaluation of Ginger Flavored Herbal Milk
The qualities considered during the study were appearance, color, flavor, taste, Mouth feel and overall acceptability. Processed Herbal milk ranked excellent in all the qualities. Data pertaining to the initial organoleptic evaluation of the Milk are presented in table 2.

Table 2: Organoleptic characteristics of Herbal Milk before storage.

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Herbal Milk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>12.8</td>
</tr>
<tr>
<td>Colour</td>
<td>12.2</td>
</tr>
<tr>
<td>Flavour</td>
<td>13.2</td>
</tr>
<tr>
<td>Taste</td>
<td>13.0</td>
</tr>
<tr>
<td>Mouth feel</td>
<td>12.8</td>
</tr>
<tr>
<td>Overall acceptability</td>
<td>13.5</td>
</tr>
</tbody>
</table>

Fig 1: overall acceptability of the product

Microbial evaluation of Ginger Flavored Herbal Milk
The Ginger Flavored Herbal Milk developed was analyzed initially for microbial quality. Microbial studies like total plate count (TPC), yeast and mould count, coliform and E.coli count were carried out to evaluate the safety and keeping quality of the Herbal Milk. Data pertaining to microbial evaluation of Ginger Flavored Herbal milk presented in Table 3.
Table 3: Microbiological characteristics of Ginger Flavored Herbal Milk

<table>
<thead>
<tr>
<th>Products</th>
<th>Total plate count (CFU/ml)</th>
<th>SPC (CFU/ml)</th>
<th>Yeast and mould count (CFU/ml)</th>
<th>Coliform (CFU/Ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Herbal Milk</td>
<td>15</td>
<td>7400</td>
<td>10</td>
<td>74</td>
</tr>
</tbody>
</table>

Antioxidant activity
DPPH method was used to study the Antioxidant and Iron chelating activity of the Ginger Flavored Herbal Milk and the results were tabulated in Table 3.

Table 4: Antioxidant activity of Ginger Flavored Herbal Milk

<table>
<thead>
<tr>
<th>Products</th>
<th>Activity</th>
<th>% of DPPH free radical Scavenging activity and iron chelating activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>Anti oxidant activity</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td>Iron chelating</td>
<td>55%</td>
</tr>
<tr>
<td>Herbal milk</td>
<td>Anti oxidant activity</td>
<td>55%</td>
</tr>
<tr>
<td></td>
<td>Iron chelating</td>
<td>58%</td>
</tr>
</tbody>
</table>

CONCLUSION
Herbs and nutraceuticals are natural substances with wide range of health attributes. Milk has always been a choice of innovation for food researchers to meet the ever changing consumer's preferences for newness in the products. Moreover, milk is consumed by people of all age can act as potent carrier for the herbs which can add functional attributes to the product and consumers well being. An attempt was done to develop flavored milk with the incorporation of Ginger extract and the results of the study lead to the conclusion that the addition of Ginger extract with milk sufficiently developed a significant product. Initially for Ginger flavored Herbal Milk, analysis was carried out to determine the values for different parameters. The qualities considered during the study were Physico chemical, appearance, colour, flavor, taste and overall acceptability. Microbial studies like total plate count (TPC), yeast and mould count, coliform and E.coli count were carried out to evaluate the safety and keeping quality of the Ginger Flavored Herbal Milk observed were within the acceptable range. Antioxidant and Iron chealating activity of Herbal Milk was also studied.

REFERENCES