Development of Ginger Flavoured Pasteurized Milk with Incorporation of Ginger (Zingiber officinale) Extract and Sugar

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Introduction

The Sri Lankan dairy industry is important and has tremendous potential in developing the economy in the country. Since centuries, milk is used for direct consumption as well as for making various products. With the advent of new processing techniques, many products especially such as pasteurized milk were added. Within this milk types, flavoured milk remained highly demanded. However, there was no ginger flavoured milk type among the flavoured pasteurized milk, which has antioxidant, antimicrobial and anti-tumour effect with many other medicinal values. Therefore, this research has focused to add value to flavoured milk by incorporating ginger extract.

Methodology

Ginger (*Zingiber officinale*) rhizomes were washed with water and soaked for 12 hours. Then, they were sliced (2 – 3 mm) and grinded. This mixture was heat treated for 5 minutes at 100 °C and filtered to obtain the ginger extract. Then, samples of ginger flavoured milk were prepared by incorporating ginger extract and sugar in to cow milk. There were 9 ginger flavoured milk samples by changing the volume of ginger extract as 8 mL, 10 mL and 12 mL and sugar percentages as 5%, 7.5% and 10%. For the preparation of each flavoured milk sample, relevant ginger extract volume and sugar % were added in to 100 mL of milk separately and they were pasteurized at 72 °C for 15 seconds. Plain pasteurized milk samples were used as the control. An evaluation panel comprising 5 trained panellists and 10 untrained panellists was used for first three sensory evaluations. Sensory attributes; appearance/colour, aroma/smell, pungent/ginger flavour, sweet taste, overall flavour and overall acceptability were tested using 9 point Hedonic scale (from 1-extremely dislike to 9-extreamly like). These sensory evaluations were conducted by changing the ginger extract volume while keeping the sugar % constant. With each evaluation, three best combinations were selected. Selected three samples were produced again using the same procedure and the best combination was selected by a sensory panel comprising 39 untrained members. The selected milk sample was packed in LDPE bags and stored below 4 °C for further analysis. The shelf life was determined by analysing titratable acidity (TA) and microbiological evaluations (Total Plate Count and *E. coli*). Proximate analysis was carried out by measuring the fat%, protein content, moisture% and ash content. Data obtained from sensory evaluations were analysed by Friedman test.

Results and discussion

From the first three sensory evaluations, 8 mL ginger extract volume was selected for all three sugar %. From the final sensory evaluation, ginger flavoured milk sample with 8 mL ginger extract volume and 7.5 % sugar was selected as the best sample. Results from microbiological analysis indicated that SPC of ginger flavoured milk sample did not change ($p>0.05$) throughout the tested period (11 days). The TA of selected ginger flavoured milk sample behaves similarly. Milk fat, protein, moisture, total solids and

ash content for selected milk were 3.6%, 291.6 mg, 89.9%, 10 % and 0.02 g respectively.

According to the results obtained from final sensory evaluation (Figure 1), there were no difference ($p>0.05$) in appearance/ colour among four samples. This may be due to the addition of ginger extract and sugar in law quantities which may not contribute to significant colour variation.

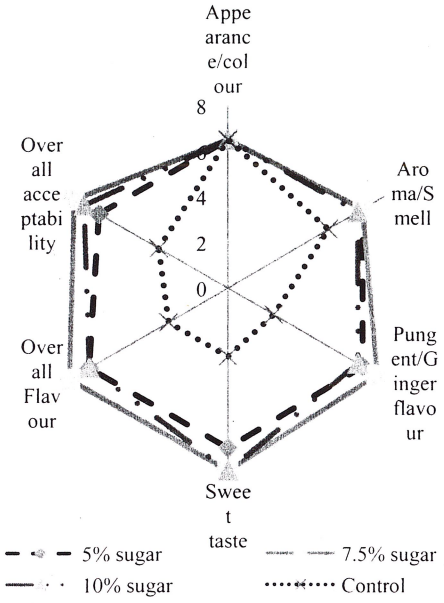

Figure 3. Variation in the sensory attributes of milk samples

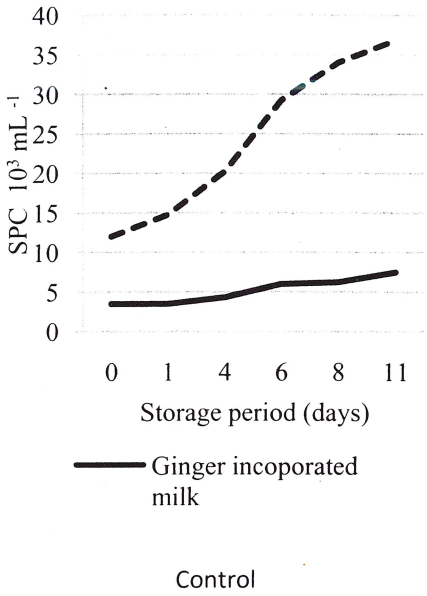

Figure 4. variation of SPC in ginger flavored milk and control

Panelists prefer milk samples with sugar percentages as 5%, 7.5% with respect to aroma/smell than other milk samples. All three ginger incorporated milk samples were preferred by the panelists than the control. This may be due to the pleasant aroma of ginger which caused by more than 70 constituents present in steam volatile oil. According to the findings of Purseglove *et al.* (1983) sesquiterpene hydrocarbon zingiberene is predominates in ginger and accounts for 20–30% of the volatile oil obtained from dry ginger.

The most preferred milk sample with respect to pungent/ginger flavour is 7.5% sugar and 8 mL of ginger extract incorporated milk sample. All three ginger incorporated milk samples were preferred by the panelists than the control. These results are in accordance with the findings of Puengphian and Sirichote (2006). He explains that the main pungent ginger constituents are oleoresins such as 6-, 8- and 10-gingerols and 6-shogaol. These constituents are well dissolved in non polar solvents such as milk fat.

Milk fat was evenly distributed all over the milk serum after the homogenization. Therefore, these oleoresins were uniformly distributed in the milk.

Results from microbiological analysis indicate that SPC (Figure 2) of the selected ginger flavoured milk sample did not change ($P>0.05$) throughout the tested period (11 days). The TA of selected ginger flavoured milk sample behaves similarly. However, SPC of the control exceeded the SLS specifications for pasteurized milk (30000 cfu/mL) at 7^{th} day of refrigerated storage. According to the above results, incorporation of ginger extract enhanced the shelf life of pasteurized milk. This may be due to the antibacterial effect of ginger.

Malu *et al.* (2008) found that the antibacterial activity and inhibition activity of ginger extracts could be due to the constituents such as sesquiterpenoids, zingiberene, β-sesquiphellandrene, bisabolene, farnesene and trace monoterpenoid fraction, (β-sesquiphellandrene, cineol and citral). Azu *et al.* (2007) also described that, these components have antibacterial and gastrointestinal tract motility effects. Ginger has the capacity to eliminate harmful bacteria, such as *E. coli*, responsible for most of the diarrhoea, especially in children. Ginger eases both diarrhoea and constipation; hence it should have impact on the growth of *Bacillus cereus*, which mainly causes diarrhoea and nausea).

Conclusions

Ginger flavoured pasteurized milk can be produced by incorporation of ginger extract. Most preferable combination is 8 mL of ginger extract and 7.5% of sugar content for 100 mL of milk. The product shelf life was expanded rather than market pasteurized milk types. The product might be having some medicinal advantages, which is derived from ginger.

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