Formulation and Development of Whey Beverage Incorporating Ginger (*Zingiberofficinale*) Powder and Lemon Flavor

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Introduction

Whey is the major by-product of cheese industry. It is generated due to the acid coagulation or rennet coagulation of milk. Whey comprises 80–90% of the total volume of milk entering the process and contains about 50% of the milk solids in the original milk such as serum protein, lactose, vitamins and minerals. Hence, it can be considered as a potentially valuable by-product (Naik *et al.*, 2009). Presently, discharging of whey is a huge problem in cheese industry. Biological oxygen demand (BOD) values for cheese whey range from 30,000 to 45,000 mg/L. Therefore, effective and economical methods of utilizing whey are essential if cheese plants are to remain competitive with other segments of the food processing industry. Production of whey beverage is one of the cost effective method of utilizing whey. Whey beverages are nutritious due to high serum protein content which is readily digestible and bio-available. However, relatively high content of minerals in whey are responsible for undesired salty-sour flavor in whey and results undesired taste in final product. Many studies have shown that, addition of natural or artificial flavors such as fruit flavors, chocolate flavor, mint flavor *etc.* can be used to overcome this problem. Ginger (*Zingiber officinale*) is most widely used condiment for various foods and beverages (Parthasarathy *et al.*, 2008) and poses as unique flavor which is preferred by people and may be used to develop whey beverage This study attempted to develop a whey beverage with good organoleptic properties by incorporating ginger extract and lemon flavor.

Methodology

Preliminary trials were carried out to find the best ginger powder level, citric acid level and the best stabilizer. Cleaned, peeled ginger rhizomes were chopped and cooked with sugar 200% (w/w) and the hardened pulp was grinded and the powder was made. The first trial was done to determine the best ginger powder level . Whey was measured and heated up to 45 °C. Then, 8% (w/w) sugar, 0.01 mL of lemon flavor and 0.01 mL Tatrazene (as colourant) were added for each sample. Ginger powder level was changed as 2.5%, 3.0%, 3.5%, 4.0% and 4.5% (w/v). Sensory evaluation was conducted to find the best ginger powder percentage using 15 trained panelists.

Second trial was done with the selected ginger powder level to determine the best citric acid level. Citric acid was used to enhance the intensity of lemon flavor. Sugar, lemon flavor, tatrazene and selected ginger powder percentages were added in to whey and citric acid levels were changed as; 0.12%, 0.16%, 0.20% and 0.24% (v/v). Sensory evaluation was conducted to find the best citric acid percentage using 15 trained panelists.

Another trial was conducted to determine the new ginger powder percentage which was compatible with selected citric acid level. For this, ginger powder level was changed as 0.6%, 0.8%, 1.0%, 1.2% and 1.4% (w/v) while keeping other ingredients unchanged. The fourth trial was conducted to find the most compatible sweetness for the product. Therefore, sugar levels were changed as6.8%, 7.0%, 7.2% and 7.4% (w/v) with selected ginger powder level and citric acid level. Other ingredients were kept constant. Sensory evaluation was conducted to find the best level of ginger powder and sugar using 15 trained panelists. Fifth trial was done to select the best stabilizer for the beverage. Three stabilizers (0.1 % w/w) were used as Pectin, Carrageenan and Carboxymethylcellulose. Beverage samples were prepared and kept in the refrigerator and observed without shaking and disturbing. The sample with lowest sedimentation was selected as the best stabilizer. For the selected sample, proximate analysis was done and shelf-life was determined by pH and titratable acidity. Microbiological quality was analyzed using Coliform count and Total Plate Count. Data were analyzed using Friedman non-parametric test with 0.05 significance level in MINITAB 14 software package.

Results and Discussion

The best citric acid level for enhancing the intensity of lemon flavor was 0.16% (w/v). The best ginger powder level which is compatible with selected flavor intensity was 1.2% (w/v). Figure 1 indicates the results of sensory evaluation

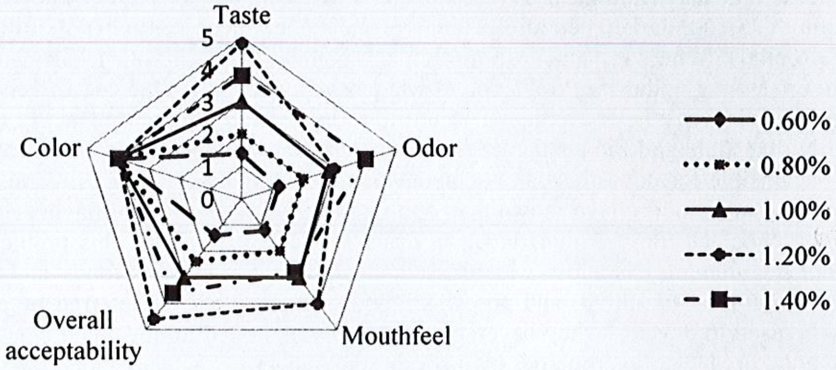

Figure 1: Sensory attributes of whey beverage with different ginger powder percentage

As indicated in Figure 1, beverage sample having 1.2 % ginger powder has highest ($p<0.05$) overall taste, mouth feel and overall acceptability compared to other four samples. Further, sample with 1.4% ginger has higher ($p<0.05$) preference with respect to odour. This may be due to high ginger content associated with the sample. According to Parthasarathy *et al.* (2008), monoterpene which is the most important contributor for the aroma of ginger is highly abundant in extracts of fresh ginger. Though, the compound responsible for flavor properties (Oxygenated sesquiterpenes) should be high in the same sample, panelists found sample with 1.2% ginger has highest ($p<0.05$) overall taste. Perhaps, this is due to the compatibility of two flavor profiles of ginger and lemon. Panelists found no difference in colour of five samples Similarly, sensory evaluation results of fourth trial indicate that, addition of 7.2% (w/v) sugar to the whey beverage gave most compatible sweetness that induced the overall flavor of the product. According to the results, Carboxymethylcellulose did not show any sedimentation until 5th day of refrigerated storage whereas the sample with carrageenan showed sedimentation at 2nd day of refrigerated storage. Proximate analysis of the final product revealed that; it has 1.6%fat, 3.64% crude protein, 3.12% ash, 10.92% carbohydrate and 19.3% total solid content per 100 g. Similarly, it contains 307.83 kJ of energy per 100g. According to the results, pH and titratable acidity of final product at day 5th was 4.98 and 0.25 lactic acid% (w/w) respectively. Therefore, it reached maximum levels of SLS specification with respect to pH and titratable acidity at 5th day of refrigerated storage (Sri Lanka standards, 1983). Figure 3 shows the coliform count and total plate count (TPC) with storage period.

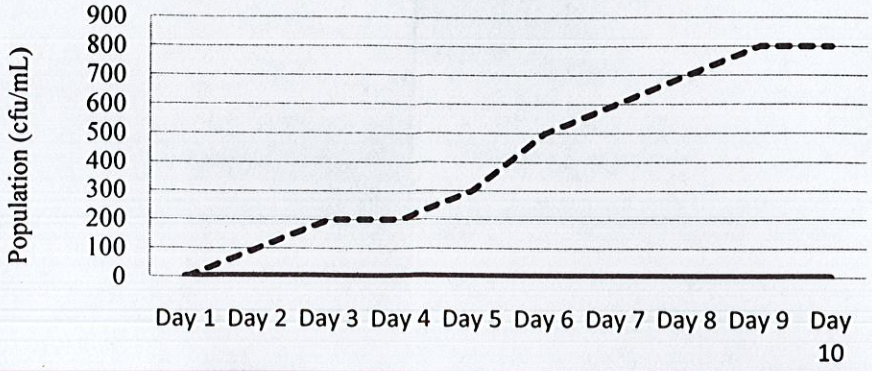

Figure 3: Change of coliform count and TPC with storage period

As indicated in Figure 3.TPC increase ($p<0.05$) after 5th day of refrigerated storage. According to the Sri Lanka Standards specifications about processed milk the maximum levels of TPC should be below 300 cfu/mL during the shelf-life. Formulated whey beverage exceeded the specified TPC level of processed milk at 5th day of refrigerated storage. There was no growth of coliform during the tested period. Cost analysis of final product showed that Rs. 23.50 was needed to produce 1 L of whey beverage.

Conclusions

A whey beverage can be developed with 1.2% (w/v) ginger powder, 0.16% (w/v) citric acid, 7.2% (w/v) sugar, 0.1 % (w/v) Carboxymethylcellulose, 0.01 mL lemon flavor and Tatrazene. The cost of production of the beverage is Rs. 23.50/ L. It has 3.64% crude protein and 307.83 kJ of energy per 100g. The shelf life of the whey beverage is 5 days under refrigerated storage.

References

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