# DEVELOPMENT OF HIGH CALCIUM MALT FLAVOURED PASTEURISED MILK

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## Introduction

Milk is a natural, multi-component, nutrient rich beverage. Recent global market trends indicate that the milk products serve as ideal vehicles for the delivery of bioactive food ingredients. The global fluid milk industry is shifting towards functional milk beverages in addition to producing conventional pasteurised and UHT milk. Calcium is the most predominantly bioactive ingredient used in foods for specified health uses while calcium fortified food products contribute to 19% of the global functional food market. Calcium fortified dairy products fetch increasing demand due to high bioavailability of fortified calcium (Singh *et al.*, 2006) and they help prevent osteoporosis. However, as there are no calcium enriched pasteurized milk products available in Sri Lanka, the local consumers do not have access to such products. The objective of the present study was to formulate a calcium fortified malt flavoured pasteurised milk for the Sri Lankan market.

## Materials

High calcium malt powder (HCMP), pasteurized full cream milk (homogenized/ milk fat 3.5%/ MSNF 8.5%), sugar, stabilizer (T-blend), skim milk powder (1.25% fat/ 3.8% water, max.) and antifoam (dowcoening antifoam-1520 emulsion) were acquired from the liquid plant laboratory of Fonterra Brands Company Private Limited. Ethylenediaminetetraacetic acid, Hydroxy napthhol blue, α-(2-naptholazo-3,6-disulfonic acid)-2-napthanol-4-sulfonic acid disodium salt and calcium chloride were procured from Hemas Chemical Private Limited, Sri Lanka and standard plate count agar (APHA-CM 0139) and potato dextrose agar (IVD-CM 0139) were procured from OXOID Company England.

## Methodology

***Laboratory preparation procedure***

The stabilizer and a portion of sugar (25% of the total) were dry blended and added into the water at 50$^0$C while shaking vigorously using a laboratory shaker to obtain a suspension. Milk was heated up to 35$^0$C and mixed for 1 min at 18,000 rpm while adding 2 g of antifoam. Subsequently, the prepared suspension was added into milk and mixed well for 2.5 min at 18,000 rpm. After adding the rest of sugar, skim milk powder and high calcium malt powder were added into the mixture and blended for 5 min at 18,000 rpm and the mixture was placed in pre-sterilized bottles. Subsequently, in-bottle pasteurization was performed for 1 min at 105$^0$C using a laboratory scale autoclave (Hirayana HA-240 M,

Japan). Immediately following pasteurisation, the bottles were cooled to 40$^0$C using ice cubes and chilled water.

**Product formulation:** In order to determine the best formula, the proportion of fat, sugar, stabiliser and malt powder was changed one at a time. The formulae were designed to provide 50% of the recommended daily intake (RDI) of calcium through consumption of 170 mL product. The formulated products were evaluated for sensory attributes in two steps on a 9-point hedonic scale by a panel of 30 semi-trained panellists. Based on the results of the analysis, two best formulae were selected. Slight changes were made to the fat and sugar contents of the selected two formulae in order to formulate four formulae with high commercial viability without changing the sensory attributes significantly. The four formulae were evaluated for sensory attributes using the same panel as explained above.

**Statistical analysis:** All sensory data were analyzed using Friedman test that under the nonparametric tests of Minitab 11.3 software and significance was tested at the 95% probability.

**Chemical analyses and shelf life determination:** The ash content was measured according to the official method of analysis (AOAC, 1996) and fat content was measured using the Gerber method. Amount of calcium of the product was analyzed using a Complexometric method explained by Dawood *et al.* (1987) with slight modifications. The formulated product was evaluated for shelf life by obtaining aerobic plate and coliform count and pH of the samples stored at 4±1 $^0$C on a daily basis over fourteen day period.

**Results and Discussion**

Based on the sensory evaluation performed, the two best formulae contained 2.8% fat, 7.2% MSNF, 12% HCMP, 4% sugar and 0.28% T-blend and 2.4% fat, 7.2% MSNF, 12% HCMP, 4% sugar and 0.28% T blend. These two formulae were not significantly different with respect to the overall acceptability. According to the sensory analysis, a 1% change in HCMP content was easily detectable. Table 1 lists the estimated median values for the product characteristics of the four final formulae.

According to results of sensory evaluation (Table 2), the sample containing 2.4% fa, 7.2% MSNF, 12% HCMP, 4% sugar and 0.28% T-blend was the most accepted by the panellists. All formulae contained 0.33% (w/w) calcium so that 170 mL of the product provide 50% of RDI of calcium. In the shelf life study, no coliforms were detected even after 14 days of storage at 4±1$^0$C while the aerobic plate count was 2566±60 CFU per 1 ml of the product after 13 days stored at 4±1 $^0$C (Figure 1).

**Conclusions**

Sensory evaluation results revealed that the product containing 2.4% fat, 7.2% MSNF, 12% high calcium malt powder, 4% sugar and 0.28% T-blend is the formula with the most accepted organoleptic characteristics. Based on the results of the storage study, the product is stable over 14 days at 4±1$^0$C.

**Table 1. Estimated median (Friedman) for product characteristics of four final formulae**

| Product characteristic | Formula 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Colour | 7.00[b] | 7.00[b] | 7.00[b] | 7.00[b] |
| Malt flavour | 7.12[b] | 6.78[c] | 6.50[c] | 7.00[b] |
| Sweetness | 7.50[a] | 7.25[a] | 6.50[c] | 7.00[b] |
| Mouth feel | 7.17[b] | 6.80[b] | 6.23[c] | 6.73[c] |
| Overall acceptability | 7.84[a] | 6.78[b] | 5.97[d] | 7.03[b] |

Medians followed by the same letters are not significant
Formula 1- 2.4% fat and 4% sugar; formula 2- 2.8% fat and 4% sugar; formula 3-2.4% fat and 3.5% sugar and formula 4- 2.8% fat and 3.5% sugar.

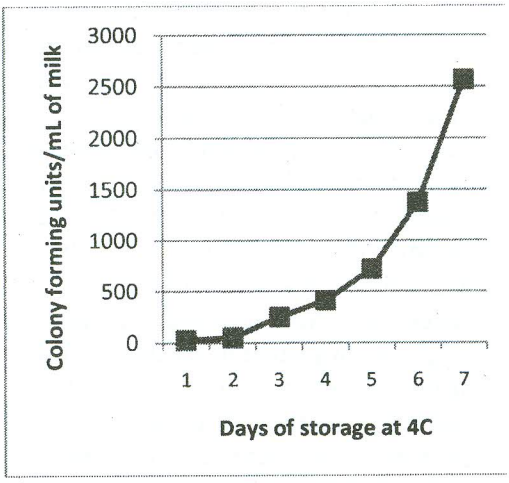


**Figure 1. The change of aerobic plate and coliform counts of the best formula over 14 days**

**Table 2. Composition of the best formula**

| Component | percentage |
|---|---|
| Total solids | 24.5 |
| Malt | 9.0 |
| Sugar | 4.0 |
| MSNF | 7.2 |
| Fat | 2.4 |
| Total ash | 1.12 |
| T-blend | 0.28 |
| Calcium | 0.33 |

## References

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