

# Stability of $\beta$ -carotene in Sterilized Flavoured Milk

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**An attempt has been made to standardize the preparation of sterilized flavoured milk satisfying the daily recommended intake of  $\beta$ -carotene. Flavoured milk enriched with 5, 7.5, 10 and 12.5% levels of carrot juice with 0.1% cardamom and 10% sugar was studied for their sensory acceptance. The expert panel rejected the 12.5% enrichment which had lowest sensory acceptance. The accepted levels of enrichment (5, 7.5 and 10% levels) were further studied for the  $\beta$ -carotene content and stability of  $\beta$ -carotene for a period of 3 months under light and dark storage conditions. Results of the study indicated that only negligible loss of  $\beta$ -carotene was observed during this period in all three enrichment levels. Sterilized flavoured milk enriched with 5%, 7.5% and 10% carrot juice of 200ml servings were found suitable for satisfying the RDA for  $\beta$ -carotene to children, adult men/women and pregnant woman respectively.**

**Keywords:** Sterilized flavoured milk,  $\beta$ -carotene, storage stability

## INTRODUCTION

Indian council for medical research has recommended a daily allowance of 3200, 4800 and 6400  $\mu\text{g}/\text{day}$  for children, adult men/women and pregnant women respectively (ICMR, 2010). Majority of the people, with their low intake of vegetables and fruit, are probably getting closer to 1 mg per day. Pasteurised flavoured milk prepared with a combination of carrot juice and cardamom had highest sensory acceptance (Ramasamy *et al.*, 2001). Kumaresan *et al.* (2008) reported that the carotene content of the carotene enriched milk drink was stable during pasteurisation and there was no significant reduction of carotene content for period of 7 days at 5°C. Ramasamy *et al.*, (2005) tried different combination of sterilized flavoured milk and showed that the colour, flavour and sensory acceptability of sterilized carotene enriched milk drink prepared with 5% carrot juice, 0.2% cardamom and 10% sugar was stable for a period of 6 months. In this study, an attempt has been made to prepare flavoured milk drink that satisfies the ICMR daily recommended allowance of  $\beta$ -carotene levels. Further, the stability of  $\beta$ -carotene in the sterilized carotene enriched flavoured milk stored at room temperature for a period 3 months was also studied.

Fresh carrot was obtained from the vegetable market and washed with water and juice was extracted. Toned milk was supplemented with carrot juice at 5, 7.5 and 10 and 12.5% levels. Sugar was added at the level of 10%. Cardamom was added as flavouring agent. Finely ground cardamom seeds were added after mixing with minimum quantity of sugar for easy grinding (@ 0.1% of the milk). The milk was heated to 80°C and homogenised at 2500 and 500 psi (two stages), filled in beverages bottle and closed with ground cork machine. These bottles are placed in the autoclave for 20 mins at 15 psi. The samples were stored at room temperature ( $28 \pm 2^\circ\text{C}$ ) inside a wooden shelf (dark storage) and on the display rack (light storage), simulating normal retail storage conditions. After sterilisation the flavoured milk samples were evaluated once in 15 days for a period 3 months for various sensory attributes such as colour, flavour and acceptability by a panel of 7 trained judges using 9 point hedonic scale where 9 was extremely good and 1 was extremely poor. The  $\beta$ -carotene content of flavoured milk was estimated by the modification of method described by Sherry and Penniston (2002), where the  $\beta$ -carotene is monitored at 450nm. The values obtained were statistically analysed as per the procedure of Snedecor and Cochran (1967).

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The sterilized flavoured milk was prepared with an addition of 5, 7.5 and 10 and 12.5% levels of carrot juice and the result of sensory acceptance is given Table 1. The sample added with 12.5% carrot juice had poor acceptability. This sample had lowest sensory score for flavour and acceptability attributes though the score for colour was in acceptable range. The samples enriched with 5, 7.5 and 10% level which were commanding a higher acceptability were selected and subjected to further storage study for β-carotene stability and shelf life.

The stability of β-carotene was studied under two different storage conditions for a period of 3 months. Milk samples had a carotene content of 0.04 mg/100 ml of sample. Hamilton et al. (1982) reported the carotene content of carrot juice as 1.06 mg/5ml. In the present study, fresh carrot juice contained 1.59 mg β-carotene/ 5 ml of juice. This difference may be due to strain variation in carrot and method of extraction. The β-carotene content of three samples at two different storage conditions is given in Table 2. The initial content of β-carotene was 1.62, 2.26 and 3.20 mg/100 ml for 5, 7.5 and 10% carrot juice enriched samples

respectively. Indian council for medical research has recommended a daily allowance of 3200, 4800 and 6400 µg/day for children, adult men/women and pregnant women respectively (ICMR, 2010). Hence, the sterilized flavoured milk enriched with 5, 7.5 and 10% levels of 200ml servings would satisfy the recommended daily intake for children, adult men/women and pregnant women per day per person.

In light storage, both the samples showed a decreasing trend and by the end of 3 months storage there was a decrease of 0.11, 0.12 and 0.14 mg/100ml β-carotene respectively in 5, 7.5 and 10% carrot juice enriched flavoured milk. In dark conditions though a similar decreasing trend was evident, the rate of decrease is slow when compare to that of light storage. The results obtained were similar to the ones reported by Chen et al. (1996).

In conclusion, results indicated sterilized flavoured milk enriched with 5, 7.5 and 10% level of carrot juice enrichment had excellent sensory characteristics in terms of colour, flavour and acceptability. Moreover, β-carotene was stable and shown little destruction even

**Table 1 : Sensory acceptability of flavoured milk enriched with three different levels of carrot juice (β-carotene)**

Sample	Colour	Flavour	Acceptability
Carotene enriched milk (5% level)	8.82 ± 0.16a	8.83 ± 0.06 a	8.87 ± 0.11 a
Carotene enriched milk (7.5% level)	8.80 ± 0.06 a	8.86 ± 0.12 a	8.84 ± 0.13 a
Carotene enriched milk (10% level)	8.81 ± 0.08 a	8.89 ± 0.05 a	8.79 ± 0.10 a
Carotene enriched milk (12.5% level)	6.11 ± 0.05b	2.33 ± 0.12b	1.86 ± 0.10b

Results are expressed as Mean ± SD, where n=6. Means bearing different superscripts differ significantly (P<0.05)

**Stability of Carotene content in the sterilised carotene enriched milk drink at different storage conditions for a period of 3 months**

Storage Periods and storage conditions	β-Carotene Content (mg/100ml)		
	5% Enrichment	7.5% Enrichment	10% Enrichment
<b>Light Storage</b>			
1st Day	1.62 ± 0.09a	2.26 ± 0.11a	3.20 ± 0.10 a
30th Day	1.58 ± 0.11a	2.23 ± 0.19 a	3.16 ± 0.08 a
60th Day	1.55 ± 0.12 a	2.18 ± 0.20 a	3.11 ± 0.05 a
90th Day	1.51 ± 0.20 a	2.14 ± 0.14 a	3.06 ± 0.14 a
<b>Dark Storage</b>			
1st Day	1.62 ± 0.04 a	2.26 ± 0.04 a	3.20 ± 0.10 a
30th Day	1.60 ± 0.12 a	2.24 ± 0.14 a	3.18 ± 0.14 a
60th Day	1.58 ± 0.07 a	2.20 ± 0.11 a	3.15 ± 0.12 a
90th Day	1.56 ± 0.15 a	2.18 ± 0.02 a	3.12 ± 0.06 a

Results are expressed as Mean ± SD, where n=6. Means bearing different superscripts differ significantly (P<0.05).

after three months of storage at room temperature under light storage.  $\beta$ -carotene content in 200ml servings of 5, 7.5 and 10% levels were 3.2, 4.5 and 6.4 mg respectively, which would satisfy the recommended daily intake for children, adult men/women and pregnant women per day per person.

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