Spray drying technology is most suitable technique for producing milk powders and the removal of moisture, which prevents the growth of microorganisms by reducing the water activity and facilitates preservation and storage of milk constituents (Schuck, 2002). It also used to encapsulate carotene from carrot (Desobry et al., 1998). Pure β-carotene encapsulated with Maltodextrin also is preserved by spray drying (Desobry et al., 1997). Today there is a demand for ready-to-serve convenience foods among consumers. Ready to serve foods are those, which are consumed immediately without much cooking, like milk powder. Powder milk water content ranges from 3-5%. This low moisture powder is used as milk in lean season by reconstitution with water as a ready to serve food to the consumer.

Cardamom acts flavouring agent in food products. Cardamom health benefits are Antioxidant, Blood pressure lowering, fibrinolysis enhancing, diuretic and sedative (Dhulap et al., 2008). Carrot is an important root vegetable, rich in carotenoids (Sharma et al., 2012) vitamin C, calcium, iron and magnesium (Olalude et al., 2015). Carrot root have anti-oxidant activity, and have about 80% linoleic acid (Arabshahi et al., 2007).

In recent years free radicals are mostly noticed for human diseases. These are generated in our body by exposure to different physicochemical conditions. Free radicals can adversely alter lipids, proteins and DNA causes lipid peroxidation, loss of enzyme activity and mutagenesis and carcinogenesis (Devasagayam, 2004). High intake of dietary fat is associated with high health hazards. Current day consumers demand is increasing for low fat foods made with value added ingredients, Hence the present on ready to reconstitute milk beverage by using skim milk, 20% carrot juice and 0.2% of cardamom will cater the needs of consumer and provide health benefits to all the age groups.

**MATERIALS AND METHODS**

**Cow milk:** High quality fresh milk obtained from crossbred cows at the ILFC, Veterinary College and Research Institute, Namakkal, Tamil Nadu.

**Carrot juice and Cardamom:** Good quality fresh carrots and cardamom were purchased from local market.

**Experimental design**

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Control</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skim milk (ml)</td>
<td>1000</td>
<td>900</td>
<td>850</td>
<td>800</td>
</tr>
<tr>
<td>Carrot juice (ml)</td>
<td>-</td>
<td>100</td>
<td>150</td>
<td>200</td>
</tr>
<tr>
<td>Cardamom (g)</td>
<td>-</td>
<td>1</td>
<td>1.5</td>
<td>2</td>
</tr>
<tr>
<td>Total (ml)</td>
<td>1000</td>
<td>1000</td>
<td>1000</td>
<td>1000</td>
</tr>
</tbody>
</table>

NAAS Rating (2017)-4.43
Flow chart for the preparation of ready to reconstitute milk beverage

1. Milk
2. Cream separation
3. Skim milk
4. Addition of carrot juice and cardamom powder
5. Filtration
6. Preheating (70°C)
7. Homogenization (First stage - 2500 psi & Second stage - 500 psi)
8. Pasteurization (72°C for 15 seconds)
9. Loading into the spray dryer

Parameters setting

- Inlet Temperature
  - Set 1-185.5°C
  - Set 2-195.5°C

- Outlet Temperature
  - Set 1-102.5°C
  - Set 2-105.5°C

- De-block nozzle
  - On-1 second
  - Off-60 seconds

- Feeding rate of carrot flavoured milk = 6.0 rpm

Packaging and storage (32°C)

Table 1: Sensory evaluation for selection of treatment

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Colour and appearance</th>
<th>Flavour</th>
<th>Consistency</th>
<th>Overall acceptability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>7.67 ± 0.30</td>
<td>8.11 ± 0.25</td>
<td>8.06 ± 0.32</td>
<td>7.44 ± 0.38</td>
</tr>
<tr>
<td>T1</td>
<td>7.09 ± 0.14</td>
<td>7.35 ± 0.56</td>
<td>7.00 ± 0.52</td>
<td>7.17 ± 0.60</td>
</tr>
<tr>
<td>T2</td>
<td>8.00 ± 0.45</td>
<td>8.17 ± 0.40</td>
<td>7.83 ± 0.65</td>
<td>7.83 ± 0.65</td>
</tr>
<tr>
<td>T3</td>
<td>8.00 ± 0.63</td>
<td>8.50 ± 0.50</td>
<td>8.50 ± 0.34</td>
<td>8.50 ± 0.50</td>
</tr>
</tbody>
</table>

Different lowercase superscripts in a row differ significantly (P<0.05): Based on the sensory evaluation T3 has higher overall acceptability. Hence this treatment is selected for further studies of this research. Storage study analysis includes sensory evaluation and physico chemical properties have been analyzed for this study.

Physico-chemical analysis of ready to reconstitute milk beverage

1. pH: The pH of ready to reconstitute milk beverage powder was determined by mixing 10g of powder with 10 ml of glass distilled water and dipping the electrode directly into the slurry.

2. Solubility index: Solubility index of ready to reconstitute milk beverage powder was estimated according to IS: SP18 (part XI) 1981.

3. Moisture: 10 g of sample was taken in a dry petridish and placed in an oven at 102±2°C for 3 hrs. The samples were desiccated, weighed and moisture content was calculated.

4. Ash: 10 g of sample was weighed in silica crucible and the crucible was placed in a muffle furnace 550°C for 3 hrs. The crucible taken out and cooled in a desiccator to room temperature then weighed and the ash content was calculated.

Statistical analysis: The data obtained in all the experiments were statistically analyzed by ANOVA (Snedecor and Cochran, 1994).

RESULTS AND DISCUSSION

The sensory evaluation of ready to reconstitute milk beverage (Table 2) revealed the selected treatment (T3) didn't show any significant difference in the aspect of colour and appearance and flavour. The score for consistency and overall acceptability shows significant difference (P<0.05) between 120 days and other storage periods. The results are similar to the results obtained by Bigueja (2012) in passion fruit and guava fruit powder and Singh et al (2005) in carrot juice blended with skim milk beverage.
Physico-chemical parameters of ready to reconstitute milk beverage (Table 3) showed that the selected treatment (T3) are within the standards during entire storage period, same kind of results were observed by Kajal et al (2012). According to Cristina et al (2012) the moisture and solubility index values of infant formula were not changed during storage period. Same kinds of results were observed by Semeniuc et al (2008) in whole milk powder. Supplee and Bellis (1925) reported that low initial moisture content powders has more solubility than higher moisture content powders.

The prepared ready to reconstitute milk beverage shows very good physico chemical properties with more nutritional benefits for recent consumers demand, further it will be used as a natural health drink and have long storage stability (more than four months) in the room temperature without spoilage. Hence this study concluded that low fat ready to reconstitute milk beverage can be prepared by spray drying technology using skim milk, 20% carrot juice and 0.2% of cardamom with good sensory and physico chemical properties.

**REFERENCES**


