TECHNOLOGY DEVELOPMENT AND CALORIE REDUCTION IN FLAVOURED MILK

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ABSTRACT
A technology for low calorie flavoured milk was developed by using artificial sweeteners and through cream separation from buffalo milk. Three type of flavoured milks viz. toned milk; doubled toned milk and skim milk were prepared using the developed standardized technology. A reduction in calorie of 30.59 per cent, 36.09 per cent and 43.54 per cent was achieved from these milks, respectively, in comparison to flavoured milk prepared using sugar. Economics of the production of flavoured milks was calculated and it was found that with a capital investment of about one lac, a monthly income of about Rs. 20,000 can be generated by an entrepreneur using this technology.

Key words : Calorie reduction, Flavoured milks, Asparame, Saccharin, Proximate, Economics.

INTRODUCTION
With the advent of urbanization and changes in socio-economic set up, fast foods are gaining ground. Generally, only junk foods are considered as fast foods whereas fruits, milk etc. also lie in the category of fast foods, which not only take very less time to consume but are full of nutrition also. Flavoured milk is also a delicious drink that comes in this category but the only disadvantage it has is its high sugar content which give empty calories. The high amount of fat is also undesirable as per the general medical recommendations. Therefore, in this study, fat was removed partially and wholly to prepare toned, doubled toned and skim milk. They were then added with flavor and artificial sweeteners with a combination of aspartame and saccharin. Artificial sweeteners are from the compounds that mimic the effect of sugar on tongue. They generally pass through the human body unmetabolized i.e. without possessing any calorie. Over 90 countries have approved the use of saccharin. In India saccharin is one of the three sweeteners presently permitted under PFA act 1954 (Mahindru, 2000). The FAO/WHO and other regulatory bodies and agencies, in about 50 countries, have assessed aspartame as being safe for consumption provided that the Average Daily Intake by human is less than 40 mg/kg body weight (Lawrence, 1993). Henkel, (1999) discussed the use of sugar substitutes (aspartame, saccharin, acesulfame potassium and sucralose) in the USA and concluded that they could be a helpful part of an overall weight control program that includes exercise and other dietary factors.

MATERIAL AND METHODS
Procurement and standardization of milk : Pasteurized buffalo milk was procured from the Experimental Dairy Plant of Department of Animal Products Technology, CCS Haryana Agricultural University, Hisar and was standardized to 3.0, 1.5 and 0 per cent fat to prepare toned, double toned and skim milk, respectively.

Repasteurization of milk : All three types of milks when required were repasteurized at 63±0.5°C for 30 minutes.

Procurement of sweeteners and essence :
Saccharin : Saccharin in pellet form as Sweetex* of the Boots Company Ltd., U.K. was used. Each pellet was of approximately 11 mg.
Aspartame : Aspartame of Acme Diet Care Pvt. Ltd. marketed by Cadila Health Care Limited,

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Ahmedabad in pellet form was used. Each pellet contained an average of 18 mg of aspartame.

**Cane Sugar**: Good quality commercial grade cane sugar was used as sweetener in control samples.

**Essence**: Pineapple Essence of Bush Boke Allen (India) Ltd., Chennai was used.

**Color**: The matching color of pineapple essence of the Bush Boke Allen (India) Ltd., Chennai was used.

**Chemical analysis of milk**: The developed products were analyzed for fat, total solids, ash, total protein and total carbohydrates.

**Fat**: The fat content of milk was determined by Gerber method (BIS, 1989).

**Protein**: The protein content of milk was determined by the micro-kjeldhal method described in BIS (1989). A factor of 6.38 was used for the conversion of nitrogen to protein per cent.

**Total solids**: Total solids were determined by gravimetric method (BIS, 1989).

**Ash**: The ash content of milk was determined by BIS (1989) method.

**Carbohydrates**: Total carbohydrates were determined by subtracting the protein, ash and fat contents of the milk from the total solids of the milk.

**Calorie calculation**: The calorie value of milks has been calculated assuming that fat, protein and carbohydrates give 9, 4 and 4 calories per gm/ml, respectively.

**RESULTS AND DISCUSSION**

**Technology of the developed products**: Three types of low calorie flavoured milk were developed i.e. flavoured Toned milk, Double toned milk and Skim milk. Figure 1 shows the flow chart of the developed flavoured milks. Buffalo milk was standardized for fat and SNF per cent with respect to standards of Toned, Double toned and skim milk. Milk was pasteurized in HTST pasteurizer (72°C for 20 sec.). For control samples sugar was added at the rate of 7 per cent and to make its equi-sweet, saccharin and aspartame were added at the rate of 33mg + 360mg/lit, respectively. Pineapple essence along with matching color was used. Samples were repasteurized at 63±0.5°C for 30 minutes and stored at 5±1°C.

**Figure 1. Flow chart for preparation of low calorie flavoured milk.**

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Raw milk
↓
Standardization
↓
Toned Milk Double toned milk Skim milk
↓
Pasteurization
↓
Addition of sweeteners (saccharin: aspartame)
↓
Addition of essence and color
↓
Re-pasteurization
↓
Cooling
↓
Filling and Sealing
↓
Storage
(5±1°C)
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**Proximate composition**: Samples of the developed products were analyzed for proximate composition. Results are presented in Table 1, 2 and 3 and discussed below.

**Proximate composition of flavoured toned milk**: Flavoured toned milk sweetened with sugar contained 19.68±1.17 per cent total solids as compared to flavoured milk sweetened with artificial sweetener, which had 12.75±1.12 per cent of total solids. The protein and ash contents were 3.92±0.72 and 3.97±0.75 and 0.81±0.006 and 0.80±0.06 per cent in control and sweetener samples, respectively. Taking milk fat caloric value as 9 calorie per g/ml and protein and carbohydrates as 4 calorie per g/ml each, the calculated calorie value per 100 ml for flavoured toned milk sweetened with sugar was calculated to be 90.48 calories/100ml and same for the flavoured milk sweetened with artificial sweeteners was calculated as 62.80/100 ml. A reduction of 30.59 per cent in caloric value was achieved.

**Proximate composition of flavoured double toned milk**: The values obtained for flavoured double toned milk for TS, protein and ash contents were 18.07±0.95, 3.95±0.75, 0.80±0.04 per cent for the milk sweetened with sugar and 11.17±0.92, 3.98±0.78, 0.81±0.05 per cent for the milk...
sweetened with artificial sweeteners, respectively. The total calorie calculated for the former was 76.58 and 48.94 for the later. Thus, a reduction in caloric value of 36.09 per cent was achieved in flavoured double toned milk.

**Proximate composition of flavoured skim milk:** The flavoured skim milk sweetened with sugar had 16.45±1.12, 3.72±0.70 and 0.81±0.03 per cent TS, protein and ash contents respectively and milk sweetened with artificial sweeteners contained 9.65±0.95, 3.85±0.75 and 0.82±0.04 per cent as total solids, protein and ash, respectively. The calculated calorie per 100 ml of the flavoured skim milk obtained were 62.56 for the flavoured skim milk containing sugar and 35.32 for the flavoured skim milk containing sweeteners. Thus, a reduction in caloric value of 43.54 per cent was achieved. This more reduction in caloric value achieved in flavoured skim milk was due to absent of fat which is a high caloric constituent in the milk.

The new EU sweetener guideline, transformed into German national law on 1 January 1996, envisages a lowering of energy content by 30 per cent when sweeteners are added to a product in order to claim a more intensive fruity flavour. Such flavoured milks can be described as containing ‘sugar and sweetener’ in order to discriminate between these products (Anonymous, 1996). Cortade, (1997) reported that today, different substitutes could be used allowing calorific decreases of up to 40 per cent, but their application requires international and national adjustment of the rules.

Since June 1994 according to European legislation, ‘with caloric reduction’ signifies 30 per cent decrease in energy value.

In the present investigation, a reduction in the calorie value was observed from 36.6 to 43.5 per cent making the developed products free from sugar. The products under study could be recommended as one of the dietetic foods for diabetics, obese and for the people to whom low cholesterol diets are recommended.

**CONCLUSION**

A calorie reduction of 30.59 to 43.54 per cent

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**Table 1.** Proximate composition and calorie reduction in flavoured toned milk.

<table>
<thead>
<tr>
<th>Constituents</th>
<th>With sugar (7%)</th>
<th>With artificial sweetener (33 mg saccharin + 360 mg aspartame /lit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fat</td>
<td>3.00±0.10</td>
<td>3.00±0.01</td>
</tr>
<tr>
<td>Protein</td>
<td>3.92±0.72</td>
<td>3.97±0.75</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td>11.95±0.92</td>
<td>4.98±0.92</td>
</tr>
<tr>
<td>Ash</td>
<td>0.81±0.06</td>
<td>0.80±0.06</td>
</tr>
<tr>
<td>Total solids</td>
<td>19.681.17</td>
<td>12.75±1.12</td>
</tr>
<tr>
<td>Calculated calories per 100 ml</td>
<td>90.48</td>
<td>62.80</td>
</tr>
<tr>
<td>Reduction in calories in artificially sweetened milk</td>
<td>–</td>
<td>30.59 per cent</td>
</tr>
</tbody>
</table>

Values are the mean of 3 replications.

**Table 2.** Proximate composition and calorie reduction in flavoured double toned milk.

<table>
<thead>
<tr>
<th>Constituents</th>
<th>With sugar (7%)</th>
<th>With artificial sweetener (33 mg saccharin + 360 mg aspartame /lit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fat</td>
<td>1.50±0.05</td>
<td>1.50±0.05</td>
</tr>
<tr>
<td>Protein</td>
<td>3.95±0.75</td>
<td>3.98±0.78</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td>11.82±0.85</td>
<td>4.88±0.94</td>
</tr>
<tr>
<td>Ash</td>
<td>0.80±0.04</td>
<td>0.81±0.05</td>
</tr>
<tr>
<td>Total solids</td>
<td>18.07±0.95</td>
<td>11.17±0.92</td>
</tr>
<tr>
<td>Calculated calories per 100 ml</td>
<td>76.58</td>
<td>48.94</td>
</tr>
<tr>
<td>Reduction in calories in artificially sweetened milk</td>
<td>–</td>
<td>36.09 per cent</td>
</tr>
</tbody>
</table>

Values are the mean of 3 replications.

**Table 3.** Proximate composition and calorie reduction in flavoured skim milk.

<table>
<thead>
<tr>
<th>Constituents</th>
<th>With sugar (7%)</th>
<th>With artificial sweetener (33 mg saccharin + 360 mg aspartame /lit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fat</td>
<td>0.0±0.1</td>
<td>0.0±0.1</td>
</tr>
<tr>
<td>Protein</td>
<td>3.72±0.70</td>
<td>3.85±0.75</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td>11.92±0.92</td>
<td>4.98±0.84</td>
</tr>
<tr>
<td>Ash</td>
<td>0.81±0.03</td>
<td>0.82±0.04</td>
</tr>
<tr>
<td>Total solids</td>
<td>16.45±1.12</td>
<td>9.65±0.95</td>
</tr>
<tr>
<td>Calculated calories per 100 ml</td>
<td>62.56</td>
<td>35.32</td>
</tr>
<tr>
<td>Reduction in calories in artificially sweetened milk</td>
<td>–</td>
<td>43.54 per cent</td>
</tr>
</tbody>
</table>

Values are the mean of 3 replications.
in flavoured milks can be achieved by partial removal of fat from milk and replacing sugar with a combination of saccharin and aspartame (33mg + 360mg/lit).

REFERENCES