Sensory and chemical quality of bottle gourd halwa prepared using skim milk powder

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ABSTRACT
The present investigation has been aimed to study the effect of replacing khoa with skim milk powder on sensory characteristics and chemical composition of fresh bottle gourd halwa. Control bottle gourd halwa from khoa (To) and four lots of experimental bottle gourd halwa samples were manufactured by incorporating skim milk powder (in the form of reconstituted skim milk) at 10 (T1), 20 (T2), 30 (T3) and 40 (T4) per cent (w/w) of shredded bottle gourd. The fresh bottle gourd halwa samples were analysed for sensory (colour and appearance, body and texture, flavour and overall acceptability) and chemical (moisture, fat, protein, total carbohydrate and ash) qualities. The product prepared using 20% SMP (w/w) of shredded bottle gourd was found most acceptable on the basis of overall acceptability among the experimental products and at par (P>0.05) with the control product. Proximate analysis indicated that on increasing the proportion of SMP; fat and moisture showed a decreasing trend and reverse in case of protein, total carbohydrate and ash contents. As the level of SMP increases the cost of bottle gourd halwa also increased.

Key words: Bottle gourd halwa, Chemical composition, Cost structure, Sensory analysis, Skim milk powder.

INTRODUCTION
Dairying in India has played a predominant role in up-gradation of socio-economic conditions of the people. The milk revolution in India reveals an exceptional success story as reflected by maintaining the first position in milk production since 1998 overtaking the United States of America. The milk production of India in the year 2015-16 has reached to 155.5 million tons and estimated demand for milk is likely to be around 200 million tons in 2021-22 (Anonymous, 2017). Milk utilization pattern reveals that indigenous dairy products are India’s largest selling and most profitable segment after liquid milk accounting for 50-55 per cent of milk produced in the country (Modha et al., 2015), while 5-6 per cent of total milk produced is used for the manufacturing of western dairy products such as ice cream, butter, cheese, powder, etc. (Pal and Raju, 2010).

In recent years, a lot of interest has been gained in the development of composite food and milk based sweets prepared by combining one or more dairy products with appropriate non-dairy ingredients. These products have higher demand and profit margin (Gaikwad et al., 2015) and having the nutritional value of both milk and non-dairy ingredients such as fruits, vegetables or cereals. Amongst them, khoa based sweets like bottle gourd halwa is very popular.

The manufacture of these products by replacing khoa with milk powder as one of the ingredient would help manufacturers and consumers. The replacement of khoa with milk powder would solve the problem of using inferior quality of khoa in preparation of indigenous dairy products which helps in supply of safe food to the consumers and it would generate demand of milk powder, this will benefit both dairy plants and milk producers.

Bottle gourd fruits have cooling effect on human body as well as it acts as a good laxative. It can be used for making sweets like kheer, peetha, burfi and rayata, etc. (Anonymous, 2010). Parle and Kaur (2011) reported that bottle gourd (fruit, juice, seeds and powder) possess antihyperlipidemic, analgesic, anti-inflammatory, diuretic, antioxidant, immuno-modulatory, cardioprotective, anthelminthic and hepatoprotective properties. Therefore, the present investigation is aimed to develop good quality bottle gourd halwa by replacing khoa with SMP and to evaluate the sensory, chemical analysis and cost structure of developed bottle gourd halwa.

MATERIALS AND METHODS
The work was carried out in the Department of Dairy Engineering of Sheth M.C. College of Dairy Science, Anand Agricultural University, Anand (G.J.). “SAGAR” brand skim milk powder manufactured by Amul Fed Dairy (Mother Dairy, Gandhinagar) was procured from the local market of Anand, Gujarat. Fresh khoa and ghee were procured from the Department of Dairy Processing

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Shredding of bottle gourd: Young matured bottle gourd of variety (cv. ABG-1) was purchased from local market and thoroughly washed with clean water. The vegetable was peeled to remove outer skin and then cut into two halves with the help of sharp knife. These pieces were grated into fine shreds using a food processor to get uniform sized shreds, removing objectionable thick pulp from the shreds obtained.

Preparation of 50 per cent TS reconstituted skim milk: In this process required quantity of skim milk powder and water were measured and kept a side. Water was boiled for 5-10 min. then cooled to 40 °C. At this stage calculated amount of skim milk powder was mixed followed by filter off the undispersed lumps etc. by means of a muslin cloth. Freshly prepared 50% TS reconstituted skim milk was used in preparation of experimental bottle gourd halwa.

Preparation of bottle gourd halwa: The flow diagram of the method followed for the manufacture of bottle gourd halwa is depicted in Figure 1. The fresh bottle gourds were washed, peeled and shredded in the food processor. Shredded bottle gourds were roasted in ghee (@ 7 per cent w/w of shredded bottle gourd). The water liberated from the bottle gourd shreds is adequate for cooking of the content or little water is required for proper cooking of the shredded material. When the shredded bottle gourd became soft, sugar (@ 30 per cent w/w of shredded bottle gourd) was added and the operation of concentration was continued till desired lump formation stage was achieved. Then previously made 50 per cent TS reconstituted skim milk (SMP @ 10, 20, 30 and 40 per cent w/w of shredded bottle gourd) was added and heating was continued with stirring for 5-10 min. The permitted food grade apple green colour was added at this stage to impart little greenish appearance of the product. As soon as desired consistency was attained, cardamom was also added and the content was removed from the fire. Then product was transferred to a tray and kept in cool dry place for 4-5 h for setting. Control product (bottle gourd halwa using khoa) was prepared according to the method reported by Aneja et al. (2002).

Treatment details: The following proportions of SMP level on the basis of bottle gourd shreds were used. Whereas sugar @ 30% and ghee @7% (w/w) of shredded bottle gourds were kept constant in all experimental trials.

To = Control product (bottle gourd halwa made using khoa)
T1= 10% SMP on bottle gourd shreds weight basis
T2= 20% SMP on bottle gourd shreds weight basis
T3= 30% SMP on bottle gourd shreds weight basis
T4= 40% SMP on bottle gourd shreds weight basis

Sensory evaluation: The nine-point hedonic scale was used for evaluating the sensory qualities of bottle gourd halwa, it includes various scales of grading i.e. liked extremely (9), liked very much (8), liked moderately (7), liked slightly (6), neither liked nor disliked (5), disliked slightly (4), disliked moderately (3), disliked very much (2), disliked extremely (1) (Gupta, 1976).

Analysis: The samples of finished product from various treatment combinations were chemically analyzed for moisture (Laboratory Manual, 1959), fat (IS: 2311-1963), protein (IS: 1479-Part-II, 1961) and ash (IS: 1547-1985) and total carbohydrate (by difference). The experiment was replicated 4 times and the data was subjected to statistical analysis using completely randomized design with 5 treatments (1 control + 4 mixed ratios) as per Steel and Torrie (1980). The significance was concluded on the basis of critical difference.

RESULTS AND DISCUSSION

Effect of SMP level on the chemical quality of bottle gourd halwa: The chemical quality of finished product is presented in Table 4. The moisture content in the finished product of different treatment combinations was in the range of 20.17% to 22.58%. The decreasing moisture content was
Addition of ghee @ 7% (w/w) of shredded bottle gourd in karahi

Roasting of shredded bottle gourds in ghee

Cooking of bottle gourd shreds

Addition of sugar @ 30% (w/w) of shredded bottle gourd

Addition of skim milk powder (10%, 20%, 30% and 40%) as 50% TS reconstituted skim milk

Addition of khoa

Desiccation

Addition of food grade green colour and cardamom

Cooling (30 °C)

Experimental bottle gourd halwa (T1, T2, T3 and T4)

Desiccation

Addition of food grade green colour and cardamom

Cooling (30 °C)

Control bottle gourd halwa (To)

Chemical and Sensory analysis

Fig 1: Flow diagram for preparation of bottle gourd halwa
Table 4: Effect of SMP level on the chemical quality of bottle gourd halwa.

| Treatments | Moisture % | Fat % | Protein % | Ash % | Carbohydrate % |
|------------|------------|-------|-----------|-------|---------------|
| Control (To) | 20.17<sup>a</sup> | 11.01<sup>a</sup> | 8.59<sup>a</sup> | 1.91<sup>a</sup> | 58.34<sup>a</sup> |
| 10 % (T<sub>1</sub>) | 22.58<sup>a</sup> | 10.77<sup>a</sup> | 7.27<sup>b</sup> | 1.67<sup>a</sup> | 57.72<sup>a</sup> |
| 20 % (T<sub>2</sub>) | 24.40<sup>a</sup> | 9.21<sup>b</sup> | 8.12<sup>b</sup> | 2.16<sup>b</sup> | 58.11<sup>b</sup> |
| 30 % (T<sub>3</sub>) | 21.98<sup>b</sup> | 8.21<sup>c</sup> | 8.48<sup>c</sup> | 2.51<sup>c</sup> | 58.82<sup>c</sup> |
| 40 % (T<sub>4</sub>) | 21.54<sup>c</sup> | 7.80<sup>d</sup> | 8.69<sup>c</sup> | 2.84<sup>c</sup> | 59.13<sup>c</sup> |
| SEm± | 0.11 | 0.10 | 0.11 | 0.10 | 0.10 |
| CD (P<0.05) | 0.33 | 0.27 | 0.32 | 0.28 | 0.30 |

Values bearing abcd vary significantly (P≤0.05)

Effect of level of addition of SMP on sensory quality of bottle gourd halwa: The effect of SMP level on flavour score is presented in Table 5. The average flavour scores of the experimental samples were in the range of 8.45 (To) to 6.65 (T3). Control (To) was adjudged the best. The flavour score of control was at par (P≥0.05) with T2. There were significant (P≤0.05) differences in flavour score of treatment T1, T2 and T3. It was noted that increasing the proportion of SMP increased the flavour score of bottle gourd halwa except for the last two treatments where reverse trend was observed. This may be due to higher amount of SMP, resulted in powdery flavour in final product. As the literature pertaining to bottle gourd halwa is scanty, wherever possible the results have been compared either other sweet meats or dairy based delicacies. These results were agreement with findings of Ghule et al., (2013).

Table 5: Effect of SMP level on the sensory quality of bottle gourd halwa.

| Treatments | Flavour | Body & texture | Colour & appearance | Overall acceptability |
|------------|---------|---------------|---------------------|----------------------|
| Control (To) | 8.45<sup>a</sup> | 8.47<sup>a</sup> | 8.54<sup>a</sup> | 8.51<sup>a</sup> |
| 10 % (T<sub>1</sub>) | 7.30<sup>b</sup> | 7.45<sup>b</sup> | 7.57<sup>b</sup> | 7.51<sup>b</sup> |
| 20 % (T<sub>2</sub>) | 8.26<sup>b</sup> | 8.41<sup>b</sup> | 8.38<sup>b</sup> | 8.39<sup>b</sup> |
| 30 % (T<sub>3</sub>) | 7.86<sup>c</sup> | 7.97<sup>c</sup> | 7.22<sup>c</sup> | 7.65<sup>c</sup> |
| 40 % (T<sub>4</sub>) | 6.64<sup>d</sup> | 6.67<sup>d</sup> | 5.59<sup>d</sup> | 6.36<sup>c</sup> |
| SEm± | 0.12 | 0.13 | 0.12 | 0.13 |
| CD (P<0.05) | 0.37 | 0.38 | 0.37 | 0.39 |

Values bearing abcd vary significantly (P≤0.05)
Table 6: Cost structure of bottle gourd halwa.

| Particulars            | Cost Rs/Kg | To Qty. (kg) | Amt. (Rs.) | T1 Qty. (kg) | Amt. (Rs.) | T2 Qty. (kg) | Amt. (Rs.) | T3 Qty. (kg) | Amt. (Rs.) | T4 Qty. (kg) | Amt. (Rs.) |
|------------------------|------------|--------------|------------|--------------|------------|--------------|------------|--------------|------------|--------------|------------|
| Bottle gourd           | 15         | 1.5          | 22.5       | 1.5          | 22.5       | 1.5          | 22.5       | 1.5          | 22.5       | 1.5          | 22.5       |
| Khoa                   | 280        | 0.3          | 84         |              |            |              |            |              |            |              |            |
| SMP                    | 380        |              | 0.1        | 38           | 0.2        | 76           | 0.3        | 114          | 0.4        | 152          |            |
| Sugar                  | 42         | 0.3          | 12.6       | 0.3          | 12.6       | 0.3          | 12.6       | 0.3          | 12.6       |              |            |
| Ghee                   | 480        | 0.07         | 33.6       | 0.07         | 33.6       | 0.07         | 33.6       | 0.07         | 33.6       | 0.07         | 33.6       |
| Fuel charges           | 5          | 5            |            |              |            |              |            |              |            |              |            |
| Miscellaneous          | 5          | 5            |            |              |            |              |            |              |            |              | 5          |
| packing material,      |            |              |            |              |            |              |            |              |            |              |            |
| depreciation of utensils, etc. | |              |            |              |            |              |            |              |            |              |            |
| Labour charges         | 12         | 12           | 122.7      | 12           | 122.7      | 12           | 122.7      | 12           | 122.7      | 12           | 122.7      |
| Total expenditure Rs.  | 174.7      | 128.7        | 166.7      | 204.7        | 242.7      |              |            |              |            |              |            |

Cost structure of bottle gourd halwa: All the ingredients required for preparation of bottle gourd halwa were rated as per the prevailing market prices 2016-2017. The cost structure of bottle gourd halwa is presented in Table 6. It is revealed from Table 6 that cost of production per kg of bottle gourd halwa was found less in treatment T1 (Rs. 128.70) and highest cost per kg bottle gourd halwa was observed in treatment T4 (Rs. 242.70). The increase in the cost of production was due to increasing the addition of SMP. However, the cost of production also depends on yield of finished product. It was observed during the experimental trials that yield of T2 and T0 was same. At the same time cost of production of T2 (Rs. 166.70) was less than T0 (Rs. 174.70).

CONCLUSION

The control had highest overall acceptability score than experimental samples. Bottle gourd halwa prepared with 20% SMP level (T2) incorporation gave better sensory scores after control and at par (P>0.05) with control (T0). Fat and moisture content of bottle gourd halwa samples were decreased by increasing the proportion of SMP. In case of protein, total carbohydrate and ash content showed a decreasing trend with increasing the level of SMP. Cost of bottle gourd halwa was increased with increasing SMP level. Cost of T2 was less than T0 with same yield of finished product.

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