

Formulation and Standardisation of Apple, Beetroot, and Carrot- Incorporated Marshmallow

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Abstract—The Formulation and Standardisation of Marshmallow Incorporating Apple, Beetroot, and Carrot (ABCM) aimed to develop a healthy and nutritious alternative to traditional marshmallows. Apple, beetroot, and carrot were selected for their high nutritional value, natural colouring potential, and health benefits. Stevia was used as a natural sugar substitute to reduce calorie intake without sacrificing sweetness. The research methodology consisted of market and literature surveys, idea screening, formulation, standardisation, sensory evaluation, nutrient analysis, packaging, labelling, and cost analysis. Varying proportions of fruit extract and sweetener, three formulations, namely, ABCM1 (5%), ABCM2 (15%), and ABCM3 (10%), were prepared. Sensory evaluation, using a five-point hedonic scale by a trained panel, was conducted for appearance, colour, flavour, taste, texture, and overall acceptability. Among the samples, ABCM3 (10%) had the highest sensory score and was found to be the most acceptable formulation. Nutritional evaluation showed that the standardised ABCM3 sample contained 246 kcal of energy, 43.28 g of carbohydrates, and 17.28 g of protein per 100 g, apart from fairly good amounts of calcium, phosphorus, iron, vitamin C, and carotene. The product was packed in resealable upright pouches for freshness and convenience, and the estimated manufacturing cost was ₹85 for every 100 g, which is less than many retail marshmallow brands. Additions of natural fruit extracts enhanced nutritional value, while stevia made it attractive for health-conscious consumers. Further studies might encompass increasing its shelf life, creating more flavours, and practising ecological packaging to enhance its market potential.

Index Terms—Apple, Beetroot, Carrot, Marshmallow

I. INTRODUCTION

Despite being well-liked for their flavour and texture, confections are frequently criticised for having a high sugar content and little nutritional value. Traditionally made with sugar, gelatin, and flavourings, marshmallows offer very little in the way of nutrients. Consumer demand for wholesome and useful substitutes has surged due to growing health and wellness consciousness. The goal of this project is to create a fruit-based marshmallow using extracts from apples, beets, and carrots. Stevia rebaudiana acts as a natural, low-calorie sweetener, and these ingredients are high in vitamins, minerals, and antioxidants. The primary objective was to develop a product that enhances the nutritional value and lowers the sugar content of marshmallows without sacrificing their sensory appeal.

II. MATERIALS AND METHODS

2.1 Raw Materials

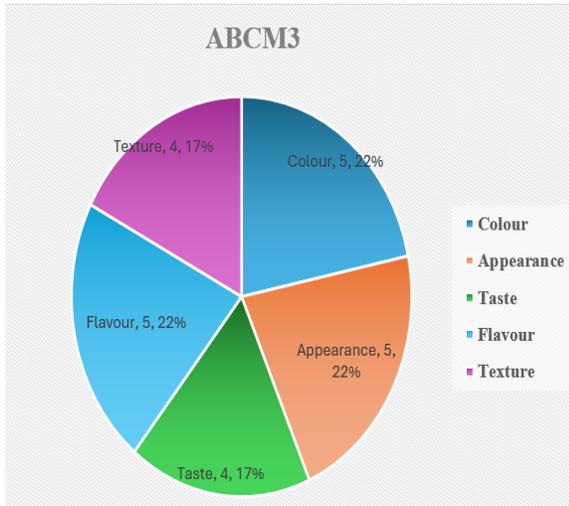
We purchased fresh carrots, beets, and apples from the neighbourhood market. Powder of Stevia rebaudiana was used as a natural sweetener. Standard suppliers provided the other ingredients, which included gelatin.

2.2 Standardisation and Formulation

Three formulations were developed:

- ABCM1: 5% fruit extract
- ABCM2: 15% fruit extract
- ABCM3: 10% fruit extract

Sensory attributes of ABCM3



2.3 Sensory Evaluation

The samples were assessed on appearance, colour, flavour, texture, taste, and overall acceptability by a semi-trained panel of ten people using a five-point hedonic scale (1 = Dislike very much, 5 = Like very much).

2.4 Nutrient Analysis

Using standard AOAC (2010) procedures, the proximate composition energy, carbs, protein, and

micronutrients (calcium, phosphorus, iron, vitamin C, and carotene) was examined.

Table:1

Nutrient Analysis of ABC Marshmallow (per 100 g)

Nutrients	Value
Energy (kcal)	312.40
Protein (g)	2.85
Fat (g)	0.52
Carbohydrates (g)	74.60
Total sugars (g)	62.30
Crude fibre (g)	3.10
Calcium (mg)	48.20
Phosphorus (mg)	62.40
Iron (mg)	2.15
Vitamin C (mg)	18.60
Beta-carotene (µg)	1125.00

2.5 Cost Analysis

The nutrient analysis indicates that ABC marshmallow is rich in carbohydrates, vitamin C, and beta-carotene due to the incorporation of fruit and vegetable pulps. Cost analysis shows that the product can be produced economically, making it suitable for small-scale production.

Table:2

Cost Analysis of ABC Marshmallow (per 100 g)

S. No	Ingredients	Quantity	Cost (₹)
1	Apple pulp	30 g	18.00
2	Beetroot pulp	20 g	6.00
3	Carrot pulp	20 g	5.00
4	Sugar	25 g	7.50
5	Gelatin	3 g	12.00
6	Citric acid	0.5 g	1.50
7	Packaging	—	5.00
	Total Cost		55.00
	Profit		15.00
	Selling Price		70.00

III. RESULTS

ABCM3 had the greatest overall acceptance score (4.6/5) out of all the formulations. A pleasing colour and natural sweetness were produced by the balanced fruit concentration. ABCM3's nutritional analysis showed 43.28 g of carbs, 17.28 g of protein, 246 kcal of calories, and important micronutrients. At ₹85 per

100 g, the product was significantly less expensive than commercial marshmallows, which cost between ₹150 and ₹300.

IV. DISCUSSION

The marshmallow's nutritional value and sensory appeal were enhanced by the addition of extracts from apples, beets, and carrots. Because stevia was used, the

product's sugar and calorie content were lowered, making it appropriate for customers who are health-conscious. Carrot and beetroot's natural pigments improved colour without the need for additional chemicals. The results show commercial potential in the wellness sector and are consistent with consumer preferences for functional and low-sugar foods.

V. CONCLUSION

Taste, nutrition, and affordability were all successfully combined in the Apple, Beetroot, and Carrot Marshmallow (ABCM) invention. Superior sensory and nutritional performance was demonstrated by the formulation containing 10% fruit extract (ABCM3). According to the study's findings, ABCM marshmallows can be a healthier substitute for candy that is appropriate for all age groups. Future research could focus on flavour diversification, shelf-life studies, and the development of sustainable products using biodegradable packaging.

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