



## **Economics of Dairy Products in a Experimental Dairy Plant**

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### **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## **ABSTRACT**

In order to ensure sustainable and economic dairy-based value-added production, it is essential to analyze the costs and Break-Even points. The study was undertaken in the Experimental Dairy Plant, National Dairy Research Institute, Karnal (Haryana) with handling capacity of ten thousand liter per day, to optimize the cost of Dairy products manufactured in the dairy plant. Burfi and Ice-cream are among the most crucial Indian dairy products processed in a dairy plant and widely consumed. Primary and Secondary data were both used to conduct this study. Primary data is supplemented by actual observation and interviewing plant personnel, and Secondary data, i.e., milk inflow, its utilization pattern, and product output, was taken from different plant ledgers. Economic analysis of this dairy product in a dairy plant is necessary to optimize the cost of each component used in manufacturing Burfi and ice cream. The dairy product will keep its presence in the competitive market, and as a result, the consumer will benefit from this optimum price. Therefore, calculated the product cost was in a dairy plant, and the fixed and variable cost was 24.56 and 75.44 percent for Burfi and 34.01 and 65.99 percent for ice cream, respectively. This

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study shows that the dairy plant has surplus production of 3721.69 kg and 1,02,082.33 cups of 100 ml of output Burfi and Ice-cream respectively, after the break-even point. The study has suggested that the quantity of Burfi and Icecream should be manufactured above recommended Break-Even Point to avoid losses. As a seasonal product, if there is a fluctuation in market demand, products could be shifted to other profitable products.

*Keywords: Burfi; icecream; milk product dairy; cost.*

## 1. INTRODUCTION

India is ranked first in global milk production, contributing 23 percent of global milk production. Dairy is the single largest agricultural commodity contributing 5 percent of the national economy and employing more than eight crore farmers directly and indirectly. India is ranked 1st in milk production, contributing 23 percent of global milk production. Milk production in the country has grown at a compound annual growth rate of about 6.2 percent to reach 209.96 million tons in 2020-21. (Economic Survey 2021-22) The per capita availability has increased considerably from 197 gm in 1997 to 427 gm in 2020-21. The rapid change in lifestyle vis-a-vis food habits and more significant influence on them will divert more expenditure towards milk and milk products. Because of the high cost of processing, the benefits are reduced for producers and consumers. Despite tremendous growth and opportunities in dairy industries, it proves that income and employment can provide by dairying entrepreneurship only after the COVID-19 pandemic. Very few studies were conducted [1-6]. A recent Ajmer Singh and Chavhan [7] study on Cooperative dairy of Haryana State. Despite these studies, the analysis of dairy plants is needed regularly. Burfi and ice cream are well-known dairy products used by all classes of society. Therefore in the dairy industry, it is essential to calculate the cost of Burfi and ice cream to fix the prices of the product will maintain the equilibrium between producer and consumer interest.

### 1.1 Objectives of the Study

The aim of the study is to optimize the cost of dairy products in manufacturing in a dairy plant so that consumers should get benefitted from the price of respective product sales in the market. Additionally, this study helps to reduce the handling and operational losses of the dairy plant.

## 2. MATERIALS AND METHODS

The present study was conducted at experimental dairy, National Dairy Research Institute, Karnal. The secondary data was collected for the year 2001-2002 from the different sections of the dairy plant. The present study has been aimed at carrying out the cost of processing and manufacturing of various dairy products in an Experimental Dairy Plant, National Dairy Research Institute, Karnal (Haryana). The secondary data were collected from the records maintained in the dairy plant for the financial year 2000-2001. These were supplemented by actual observation and interviewing plant personnel. Data on milk inflow, its utilization pattern and output of product was taken from different ledgers of the plant where entries made. The quantity of raw material and their price of the item's used for production were drawn from the records of store section. Separate records are maintained for steam boiler. The information on wages and salaries of the person employed was taken from office records of the plant. Actual observation were taken on quantity of water utilized by the plant, temperature of different stages of production, quantity of steam required for the manufacturing of product, electric power utilization was calculated on the basis of horse power of motors (kw) installed on different machineries and equipments, and running capacities of the equipments and machineries. The cost of electricity and steam was calculated by following.

### 2.1 Electricity Cost

The use of electric motor with each machine is the way for allocating the electricity expenditure on different process or on the product manufactured. However, in the plant under study, meter were not provided for each machine. Therefore, the expenditure on electricity was apportioned in the study using horsepower hours basis. Horse power hours were calculated by following formula:

Expenditure on electricity/unit (kw) = No. of horse power x No. of hours X per unit price

## 2.2 Steam Cost

The steam cost included expenditure on depreciation of boiler, building, labour, supervision of office, fuel, water, store maintenance, electricity, maintenance and consumable utensils. The total expenditure on steam was calculated on different process product on the basis of quantity of steam used. Quantities of steam required by different product were calculated by taking actual observation and using the formula [8]:

Total heat required to heat milk (Kcal) = (Quantity of milk x Specific heat x Temperature changes)/ Efficiency

Net heat utilized to heat milk (Kcal) = (h x XL) – Total heat condensate

Where,

H = Sensible heat (Kcal/Kg)  
 X = Wet steam quantity in percent,  
 and  
 L = Latent heat

Steam required to heat milk (kg) = (Total heat required to heat milk (Kcal)) / (Net steam utilized to heat milk (Kcal/kg))

## 2.3 Break-even Output (BEP)

BEP = Total fixed cost for the product / (Price - Average variable cost)

To work out the cost of production of butter and ghee, the tabular analysis technique were used to workout different cost component of butter and ghee component wise cost method by Singh, R. and Kalra et al. [1].

## 3. RESULTS AND DISCUSSION

Burfi contributed 2.27 percent share in the total revenue of the dairy. During the study period, 4906 kg Burfi was manufactured incurring fixed cost of 24.56 percent and variable cost 75.44 percent. Average cost incurred on manufacturing of Burfi was Rs.26.82 per 500gm. Component-wise cost analysis revealed that the raw material alone constituted 62.36 percent, followed by

administration and supervision 9.99 percent. Expenditure on packaging was Rs.2.5 per 500 gm of Burfi. Depreciation on equipments like condensing plant, Khoa kettle and space occupied by these equipments in building was 7.79 percent and labour expenditure was 5.19 percent were in line with findings of [1-6,9,10].

Contributory margin was highest of Rs.33.84per kg where total fixed cost was Rs.64,620.54 and average variable cost and selling price were Rs.20.23 per 500gm and Rs.40 per 500gm, respectively. After analysis of data, the break-even level of output was found to 1634.31 kg but actual output was 4,906 kg. This shows that the dairy plant is having surplus production of 3721.69 kg of output.

Ice-cream contributing 5.94 percent share in the total revenue of the dairy plant. During the study period, 1,46,542 cups of ice-cream was manufactured involving an expenditure of Rs.5,76,513.59. The percentage share of variable cost was 65.99 percent and fixed cost was 34.05 percent in the total cost of manufacturing ice-cream. The average manufacturing cost was Rs.3.93 per /100 ml cup of ice-cream.

Added cost of ingredients, raw material including cow milk, sugar, flavor and stabilizer was Rs.1.72 per cup. Packaging is more important to self life incurring an expenditure of 80 paise per cup. The expenditure due to depreciation on equipments like homogenizer, ice-cream mix tank, continuous ice-cream machine, ice-cream filling machine, deep freezer and space occupied by equipments in building was 59 paise per cup, followed by administrative and supervision expenditure amounting 47 paise per cup and labour expenditure amounting 22 paise per cup. Other components of total cost were individually less than 10 paise.

This analysis shows that contributory margin was highest Rs.4.41 per 100ml cup in case, where fixed cost was Rs.1,96,067.13 and average variable cost and selling price were Rs.2.59 per 100 ml cup and Rs.7for 100 ml cup respectively. After analysis of data, break-even level of output was found to 44,549.67cup for 100ml, but the actual output was 1,46,542 cups of 100ml. This shows that dairy plant is having surplus production of 1,02,082.33 cups of 100 ml output.

**Table 1. Component wise cost of burfi**

Sr. No.	Cost component	Total Cost (Rs.)	Fixed Cost (Rs.)	Variable Cost (Rs.)	Total Cost per unit (Rs./500gm)	Percent Cost
1	Raw material	164076.26	--	164076.26	16.72	62.36
2	Labour	13644.00	13644.00	--	1.39	5.19
3	Electricity	1835.16	--	1835.16	0.19	0.70
4	Water	233.33	--	233.33	0.03	0.09
5	Steam	5066.31	116.52	4949.79	0.52	1.93
6	Refrigeration	1205.65	103.92	1101.73	0.13	0.46
7	Administration and Supervision	26278.20	26278.20	--	2.68	9.99
8	Store maintenance	3328.77	3328.77	--	0.34	1.27
9	Quality Control	1715.00	649.13	1065.87	0.18	0.65
10	Packaging	24530.00	--	24530.00	2.50	9.32
11	Depreciation on equipments and building	20500.00	20500.00	--	1.48	7.79
12	Sundries		---	700.00	0.07	0.64
	Total Cost		64620.54	198492.14	26.82	100
	Per unit cost (Rs./500gm)	26.82 (100.00)	6.59 (24.56)	20.23 (75.44)		

Figure in parenthesis are the percentage of total cost,  
Total production in a year = 9812 Packs/500 gm

**Table 2. Component wise cost of ice-cream**

Sr. No.	Cost component	Total Cost (Rs.)	Fixed Cost (Rs.)	Variable Cost (Rs.)	Total Cost Per unit (Rs./100 ml)	Percentage Cost
1	Raw material	251677.98	--	251677.98	1.72	43.66
2	Labour	32038.07	32038.07	--	0.22	5.56
3	Electricity	2057.79	--	2057.77	0.02	0.36
4	Water	114.93	--	114.93	0.001	0.02
5	Steam	506.25	11.64	494.61	0.003	0.09
6	Refrigeration	5269.53	454.23	4815.30	0.04	0.91
7	Administration and Supervision	68763.60	68763.60	--	0.47	11.93
8	Repair and maintenance	2650.00	--	2650.00	0.02	0.50
9	Store maintenance	8710.53	8710.53	--	0.06	0.46
10	Quality Control	1556.31	589.06	967.25	0.01	0.27
11	Packaging	117233.60	--	117233.60	0.80	20.33
12	Depreciation on equipments and building	85500.00	85500.00	--	0.59	14.83
13	Sundries	435.00	--	435.00	0.002	0.08
	Total Cost	576513.59	196067.13	380446.46	3.93	100.00
	Per unit cost (100 ml cup)	3.93 (100.00)	1.34 (34.01)	2.59 (65.99)		

Figure in parenthesis are the percentage of total cost,  
Total production in a year 146542 cups/100 ml

#### 4. CONCLUSION

The study shows that Burfi and Ice-cream for which the costing were carried out fetching good profit though there was inter product difference for various cost components. Burfi and Ice-cream were produced much above the break-even output level. This study suggested that dairy plants always run above the break-even output level; otherwise, they stop production to avoid loss in a dairy plant.

Also, it is suggested that the plant should run with total capacity and efficiently to achieve a better profit margin. Ice cream fetches more profit than burfi, among all dairy products. Also, this study suggests that the small milk producer and self-help groups should engage in value-added product processing on their own by taking training from institutions to generate income and employment to support the rural economy.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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