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Estimating cost for production of wheat flour based *pinni*

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Abstract

This study has been aimed to estimate the cost of production for wheat flour based *pinni* which contains 9.13 percent protein content and 36.74 percent fat content on dry weight basis. Apart from the production conditions being simulated, the work towards the estimation of the production cost for the *pinni* was based on several assumptions with prime being 300 days of plant run and 420 kg *pinni* production capacity per day. Various heads namely, land and building, plant and machinery, manpower, administration, utilities, raw material, manufacturing, packaging, maintenance etc. were taken into account while estimating the expenditure for the production of the *pinni* in a running plant. Finally, the cost of production of *pinni* worked out considering the costs of all inputs (fixed and variable costs) was Rs. 331.42 for 1 kg.

Keywords: Pinni, protein, cost for production

Introduction

India is the top most milk producing country in the world with an annual production of 155.5 million tonnes having per capita availability of 337 g/day (NDDDB, 2017) [5] and accounting for 18.5% of world's production of milk. About 50-55 % of milk produced annually in India is converted into various Traditional Indian Dairy Products (TIDPs) (Bandyopadhyay and Khamrui, 2007, Patil, 2013) [1, 4, 7]. The market for TIDPs is the second highest after fluid milk both in value and volume having a market value of more than Rs. 100,000 crores with annual growth of 10-15 % (Patil, 2013) [4, 7]. Unfortunately the technology for the production of most of the traditional Indian milk products is confined to local sweetmeat makers (*halwais*) and like many other traditional sweets. But the changing life-styles and increased purchasing power especially among urban population has necessitated the research efforts for organized manufacturing and marketing of traditional milk products with added convenience, enhanced shelf life and added nutritive value.

Pinni is an immensely popular traditional milk-cereal based sweet of Northern states of India mainly Punjab, Haryana and Delhi. It is milk based composite sweet having dark brown colour and is granular texture. The product is a rich source of nutrients derived from milk solids as well as goodness of wheat or gram flour, nuts, dry fruits etc. It is also a rich source of fat, protein, minerals and energy. Considering its high nutritive value, traditionally *pinni* is considered as an ideal food for young ones in their growing stage, pregnant and lactating women (Singh *et al.*, 2018) [8].

Unfortunately the technology for the production of most of the traditional Indian milk products is confined to local sweetmeat makers (*halwais*) and like many other traditional sweets, the practice of *pinni* making has largely remained a cottage scale operation. Being prepared at small scale, the hygienic conditions are usually not maintained and thus inferior quality products are manufactured and marketed. At the same time due to lack of any prescribed standards laid down by any of the food standards authority, quality in terms of proximate composition, texture and microbiological counts vary a lot. Recently in order to tap the potential of traditional sweet markets, several dairies in private and co – operative sector have started their organized production.

Today, a wide range of fresh as well as packaged ethnic milk products and convenience mixes are available in market. These products are also being exported to countries having large Indian ethnic population

Also the changing economic scenario offers new opportunities to Indian dairy industry, particularly organized sector, for expanding their product profile. Many of the traditional milk products such as *channa* based sweets, *mishit doi*, *shrikhand*, *basundi* etc. which were manufactured at small scale in specific geographical locations, have now been introduced in other parts of the Indian subcontinent. These dairy delicacies have now been relished by the consumer as they possess excellent flavour, mouth-feel and exhibit characteristic textural profile. In absence of technical know-how, the large scale production of these region specific milk products in organized sector is a challenging task (Kumar *et al.*, 2006) [4].

A standard production protocol and well-defined ingredient formulation and processing parameters would facilitate large-scale production of *pinni* by organized dairy sector and also help to frame legal standards of the product. Organized production of the product at industrial scale may provide product diversification and market expansion opportunities to the dairy industry. These products not only have established market in India but also great export potential because of strong presence of Indian diaspora in many parts of the world

(Pal and Raju, 2007) [6]. Thus after laboratory level preparation of *pinni* following are the estimation of various costs towards the production of the *pinni* over plant scale becomes imperative.

Material and Methods

Milk: Freshly pooled raw buffalo milk (7.5% fat and 9.0% SNF) obtained from Institutes' cattle yard was received from Experimental Dairy of the Institute in clean, sanitized and dry aluminium can. The milk was standardized to 6.5% fat and 8.5% SNF levels for making *khoa*.

Table sugar: Food grade cane sugar (sucrose) was obtained from the local market.

Wheat flour: Wheat flour of Aashirvad brand was procured from local market. The approx composition of wheat flour was contains protein (11.8 g), fat (1.7 g), and carbohydrate (75.1 g).

Ghee: Ghee prepared from cow milk was procured from the Experimental Dairy of the Institute. The approximate composition of ghee was 99.5% fat and 0.5 % moisture.

Preparation of *khoa*: Buffalo milk was standardized to 6.5% fat and 8.5% SNF. *Khoa* samples were prepared using the method of De (2004) with some modifications.

Preparation of *pinni*: Details relating to the preparation of *pinni* are given in this section. Following process flow was adopted for the preparation of the *pinni* (fig. 1.)

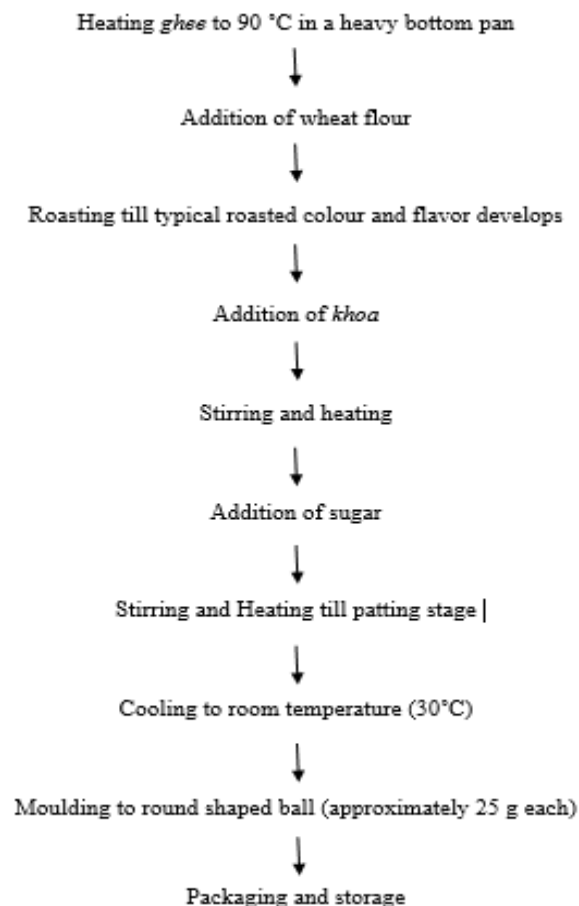


Fig 1: Process flow diagram for manufacture of wheat flour based of *pinni*

Techno-economic feasibility: Yadav *et al.*, (2015) [9] reported that for any newly developed product, evaluation of techno-economic feasibility is purposefully an important pre-requisite, before the launch of the product in the market. Therefore, it was logical to estimate expenses required for the manufacture of *pinni*. The cost of production of *pinni* was

estimated as per the guidelines reported by Kumar (2011) [3], Yadav *et al.*, (2015) [9] and Yadav *et al.*, (2016) [10], with some modifications. In order to arrive at a realistic cost of processing and that of the end product, certain assumptions were made.

Basic assumptions for cost estimation: The various

assumptions with which the cost estimation was made are given in the following sections:

1. Plant capacity: *Pinni* would be a part of composite milk plant handling 50,000 L of milk per day. 2500 L of milk would be utilized for making 420 kg *pinni* on daily basis. This would yield 126 tonnes *pinni* per annum (300 working days).
2. Manufacturing schedule: It was assumed that the plant would be operating in 2 shifts of 8 hours each. Half of the second shift was used for cleaning and maintenance of the plant. The plant would be operated for 300 days a year. The demand was expected to match with production and the product dispatch would be made on every alternate day.
3. Milk procurement: Milk would be procured through contractor, and will be delivered at the factory site in chilled condition.
4. Cost of raw material and products: All the ingredients/raw materials other than milk required for *pinni* production would be purchased from open market. Further, while calculating the value for direct cost and indirect cost, the most recent cost data available with the

Experimental Dairy Plant of the institute for the year was considered.

Result and Discussion

Capital requirement: A comprehensive list of the major processing equipment used for processing 2500 L of milk per day (for *pinni*) corresponding to 126 tonnes of the finished product per annum is given in Table 1.

The total depreciation cost for these items were calculated as Rs. 35150 (only for the production of *pinni*), the detail of which are given in Table 1. The costs shown are location specific for estimation. The same format, however, could be adapted for costing of *pinni* prepared under any given situation.

Direct costs

Cost of raw materials: For calculating the cost of various ingredients used in manufacture of *pinni*, the current (2016-2017) market rates have been considered (Table 2). The various raw materials required for manufacturing 126 tonnes of *pinni* per annum have been worked out. The total costs of raw material was estimated to be Rs. 39198000

Table 1: Raw materials costs for the production of 126 tonnes *pinni* per annum

S. No.	Raw Items	Requirement (Kg)		Rate	Annual Cost
		Daily	Annual		
1	Milk	2500	750000	30	22500000
2	Wheat Flour	1670	501000	20	10020000
3	Sugar	742	222600	30	6678000
Total					39198000

Labour and supervision: In accordance with the manufacturing operations to be performed in all operating shifts, the requirement of the personnel needed for the manufacture of the 126 tonnes of *pinni* per annum was

computed. The persons directly involved in the production are plant operators and labour. The total direct cost for labour and supervision was estimated at Rs. 948000. (Table 3)

Table 2: Items of major capital investment their cost and annual depreciation for processing 2500 litres of milk per day

Item	Particulars	No	Rate	Estimated cost	Rate of depreciation (%)	Annual depreciation	Depreciation for <i>pinni</i>
Milk reception equipment (Weighing balance, dump)	5000L/h	1	100000	100000	5	5000	500
Plate chiller (PHE)	3000L/h	1	100000	100000	5	5000	500
Storage tank	6000L/h	1	150000	150000	5	7500	750
Balance tank	250L	2	10000	20000	5	1000	100
Steam boiler	500kg/h	1	500000	500000	15	75000	7500
Steam Kettle for <i>khoa</i> making	40 L	12	50000	600000	5	30000	3000
Steam kettle for <i>pinni</i> making	42 L	10	50000	500000	5	25000	2500
<i>Pinni</i> moulding unit		1	100000	100000	5	5000	500
Packaging unit		1	300000	300000	5	15000	1500
ETP unit		1	400000	400000	5	20000	2000
Lab equipment		1	50000	50000	10	5000	500
Total				2820000		193500	19350

Labour and supervision charges are the specific for the situation considered and are the proportional to the volume of the production since these charges are likely to depend upon

the complexity of plant, extent of automation and manufacturing practices.

Table 3: Direct cost of personal for producing 126 tonnes of *pinni* per annum

S. No	Staff	Number	Monthly Salary	Monthly cost	Annual cost
1	Labour	8	2500	20000	240000
2	Skilled Labour	4	6500	26000	312000
3	Mechanical/ Electrician	2	3000	6000	72000
4	Boiler attendant	2	3000	6000	72000
5	Lab analyst	1	3500	3500	42000
6	Lab attendant	1	3000	3000	36000
7	Technical Supervisor	1	7000	7000	84000
8	In charge	1	7500	7500	90000
Total					948000

Packaging: Proper and attractive packaging not only helps in retaining the quality attributes but also promotes sale of the product. Considering the packaging charges for 500g of *pinni* as Rs.3/piece of cardboard box, the total cost of packaging for 126 tonnes of *pinni* was Rs. 756000. (Table 4)

Table 4: Cost of packaging material for *pinni*

S. No	Type of Packaging material	Requirement		Rate	Annual cost
		Daily	Annual		
1	Cardboard Boxes	840	252000	3	756000

Utilities: The utilization of various services is specific for individual plant. But for the location contemplated for costing in the present investigation, there is a cogeneration of utilities. Therefore, steam and refrigeration requirements have been estimated. Individual items of utilities services were itemized in Table 5. It may be seen that the total cost of utilities out worked out to be Rs. 288904.32 per annum. The cost of utilities, therefore, varies from plant to plant and thus needs to be figured out for given solution.

Indirect costs: The indirect costs are situation specific and are proportioned to the volume of production. Therefore, depending upon the existing facilities, the indirect costs need to be computed individually for particular situation.

Table 5: Charges on power and utilities

S. No	Particulars	Quantity Required		Rate	Annual cost
		Daily	Annual		
1	Electricity	59.094	17728.2	5.5/unit	97505.1
2	Stream	1525	457500	350/1000kg	160125
3	Refrigeration	21237.045	6371113.5	20/100000KJ	1274.2227
4	Water	10000	3000000	10/1000L	30000
	Total				288904.32

Detergents and chemicals/glassware: Under this category, the expenditure incurred as common as detergents such as caustic soda, teepol etc, are considered. The estimated for detergents is presented in Table 6.

Table 6: Cost of detergents and chemicals

S. No	Item	Annual cost
1	Caustic soda	2500
2	Glass ware / Chemicals	3000
	Total	5500

Manpower (Administration): The total indirect cost for

Table 9: Direct indirect and fixed costs for handling producing 420 kg *pinni* per day

S. No	Component	Annual Cost
A. Direct cost		
1	Raw material	39198000
2	Packaging	756000
3	Man power	948000
4	Utilities	288904.32
	Sub total	41190904.32
B. Indirect Cost		
1	Man power (Administrative)	60000
2	Estimated expenditure on detergent, glass wares and chemicals for quality control	5500
	Sub total	65500
C. Fixed cost		
1	Depreciation	19350
2	Interest	471195
3	Maintenance (equipment, building etc.)	12500
	Sub total	503045
	Total (A+B+C)	41759449.3

administration personal was calculated keeping in mind the manufacture of other products as well (Table 7)

Fixed costs: Interest on capital investment: Under the fixed costs, the elements included are interest on capital outlay that comprises fixed capital and working capital, The working capital was calculated on the basis of one month cost of raw materials and one month salary of staff who would directly involved in the production of 126 tonnes *pinni* per annum. The total fixed and working costs and their interests at the rate of 12% are given in Table 8. The total interest on these capitals was computed to be Rs. 471194.98 per annum

Table 7: Indirect cost for administrative staff for producing 126 tonnes of *pinni* per annum

S. No	Staff	Number	Monthly Salary	Monthly Cost	Annual Cost
1	Accountant cum Clerk	1	2500	2500	30000
2	Store keeper & Others	1	2500	2500	30000
Total					60000

Table 8: Interest on capital

S. No	Particulars	Amount	Annual Interest @ 12 %
1	Fixed capital (Land, Building, Plant and machinery)	563500	67620
2	Installation cost	32445	3893.4
3	Working capital (Being the value of raw material and series for one month)	3330680	399681.6
	Total		471195

Maintenance: The estimate for maintenance of equipment, building and other expenses are shown in Table 9. Rs. 12500 has been allocated towards the maintenance cost keeping in mind the production of *pinni* only.

Total costs: The various direct, indirect and fixed costs involved in the production of 126 tonnes of *pinni* per annum have been elucidated in the proceeding sections. The total of direct, indirect and fixed costs is shown in Table 9. The grand total of direct, indirect and fixed cost was estimated to be Rs 41759449.3 per annum. The total manufacturing cost was calculated to be Rs. 41759449.3 per annum. The net production cost was estimated to be 331.42 per Kg of *pinni*.

Conclusion

The estimated expense for a 1 kg pack of wheat flour based *pinni*, with health benefits was slightly higher (Rs.331.42) yet quite comparable to many similar products currently present in the market, ranging from price of Rs.300/ kg to Rs. 350/ kg. The prepared *pinni* with health benefits is expected to impart equivalent pleasure as that of conventional *pinni* to health conscious consumers. In the current health food regime, where consumers are ready to shell out extra for the product that claims to possess health benefits, the current product promises a nutritional edge (high protein) over the conventional product, which in turn can surely be entangled with expectations to attract sales.

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