Fruit Pulp and Beverage Industry of Gujarat : A Technical Case Study

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Abstract

The food industry in India is growing at a fast pace.The agro processing units are the major contributors of the food industry. This paper covers the technical survey of the fruit pulp and beverage processing industry in Gujarat, India. The season and the type of fruits being processed to manufacture pulp and beverages are also surveyed and presented in the data. The data presented in this paper shows the region wise presence of industry, scale of operation of the industry, manpower, and employment information in the industries, and the type of constrains the industry is facing.

Keywords : **Agro-processing, beverage, fruit industry, Gujarat, mango, pulp**

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India is the world's second largest producer of fruits and vegetables. The total production of fruits in India is over 92.8 million tonnes out of which Gujarat contributes to around 8.4 million tones (Horticulture Statistics Division, Department of Agriculture, Cooperation & Farmers Welfare Ministry of Agriculture & Farmers Welfare, Government of India, 2017, pp. 14 & 158). This state has achieved considerable growth rate in horticulture during the five years from 2012 to 2017.The area and production of horticulture crops were 3.52 lakh ha and 69.85 lakh tonnes, respectively in 2009-10, which increased to 3.70 lakh ha and 80.02 lakh tonnes, respectively in 2014-15 (Ministry of Statistics and Programme Implementation, Government of India, 2016, p. 178). The major fruits produce d in Gujarat are mango, guava, chiku, citrus fruits, ber, banana, guava, pomegranate, strawberry, papaya, custard apple, anola, cashewnut, and coconut.

Presently, the processing of fruits is estimated to be around 2.5% of the total production in the country. The major processed items in this segment are fruit pulp and juices, fruit based ready-to-serve beverages, canned fruits and vegetables, jams, squashes, pickles, chutneys, and dehydrated vegetables. Products that have growing demand, especially in the Middle East countries include pickles, chutneys, fruit pulps, canned fruits, concentrated pulps, juices, and frozen fruits.

Methodology

The questionnaire form including the questions for recording the minute technical details about the industry was designed. 24 fruit pulp and beverage manufacturing industries all over Gujarat were visited and surveyed to assess the current status of fruit pulp and beverage processing industries, technical abilities of plants, processing challenges, trouble-shooting, challenges faced by the industry, and opportunities present, identifying technological gap for sustainability of this sector, and to suggest research priorities for new technology development for further growth of the sector. The project was conceived in 2015 and survey and data analysis was done during 2016-17.

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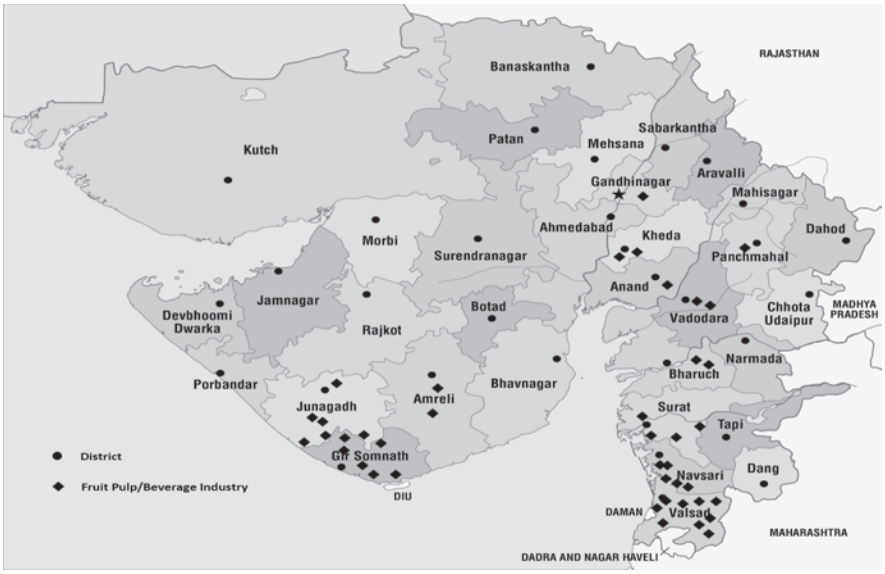
Results and Discussion

The data obtained by surveying the industries were critically analyzed to get a clear picture about the present status of the industry. The details about the industry are discussed next.

Figure 1. Geographical Distribution of Fruit Pulp and Beverage Industries in Gujarat



Maximum pulp and beverages industries are situated in South Gujarat region (47%), followed by Saurashtra Region (33%), and Central Gujarat (18%). The major reason for maximum number of industries in South Gujarat might be the availability of different varieties of fruits produced in this region as well as from nearby areas of Maharashtra. The geographical distribution of the selected industries is shown in Figure 1.There are cottage, micro, medium, and large scale industries in the proportions of 17%, 13%, 8%, and 13%, respectively. Approximately 63% of the units have less than 20 full time/permanent employees, while 42% of the units hire more than 200 employees as temporary or seasonal manpower.

Product Range

Table 1. Proportion of Fruit Pulp/Beverages Processed in Gujarat

S. No.	Product Type		Number of Units	% of Units	Installed Plant Capacity TPD (Tonnes per Day)	% of Installed Plant Capacity
1	Pulp	Mango	20	83	868.00	92.163
2		Guava	2	4	0.03	3.189
3		Black-jamun	1	8	0.03	0.011
4		Pineapple	1	4	0.10	0.008
5		Pomegranate	1	4	0.08	0.004
6		Grape	1	4	0.04	0.003
7		Strawberry	1	4	0.01	0.002
8		Star Fruit	1	4	0.02	0.001
9	Crush	Guava	2	4	3.00	2.973
10		Mango	1	8	28.00	0.319
11		Orange	1	4	3.00	0.319

12		Papaya	1	4	3.00	0.319
13		Pineapple	1	4	3.00	0.319
14		Strawberry	1	4	3.00	0.319
15	Juice	Fruit Juice	1	4	0.50	0.053

The majority of the fruit being procured and processed is mango, which accounts for 93% of the total processing of fruits. Mango is generally procured during the months of May-June, but some industries also procure different varieties from different regions during the months of March to July. The major varieties of mango being processed are Alphanso and Kesar.

The product range with its installed plant capacity for the pulp and beverage industry is detailed in Table 1. There are different pulp, crush, and juices being processed in these organizations. On the basis of installed capacity, among all types of fruit pulp, and beverages being processed in Gujarat, major share is of pulp (approximately 95.3%). Among the pulp, mango pulp (92%) is the major item followed by guava pulp.

Processing Operations

The common process flow chart followed by the industries for the processing of fruit pulp and beverages is shown in Figure 2. The first operation after receiving the fruits at the plant is to check for quality and ripening stage. The fruits are kept in natural ripening sheds constructed at plants till the fruits are fit for processing.

Primary sorting of the matured fruits is carried out for spoilt fruit, debris, ruptured fruits, leaves or other extraneous matter etc. The sorted fruits are washed with water and sent for secondary sorting and slicing section, where the damaged part of the fruit as well as pedicle is removed. Then the fruits are taken to the pulping machine through a bucket elevator, where pulping is done. The pulp is kept in intermediate storage tanks/standardization tanks, where ingredients like sugar, acids, colours, flavours, preservatives etc. are added according to the recipes. The product is then heat treated according to the type of product in heat exchangers. Then the product is cold filled or hot filled into packages, and post packaging treatments like freezing or retorting are used before labeling, and storage (Figure 2).

It was noted that the majority of the industries possess their own ripening sheds where mangoes are kept for natural ripening; none of the industry possesses controlled ripening chambers/rooms. It has been observed that majority of the industries in Gujarat are following manual methods of fruit sorting.

(1) Sorting of Fruits

Sorting of fruits to be used in processing is done in all the organizations. Sorting and manual slicing steps are labour intensive steps but no industry in Gujarat is having automatic fruit sorting facilities. Manual sorting requires many seasonal labours for the industry, which is a difficult task for the smooth running of the plant.

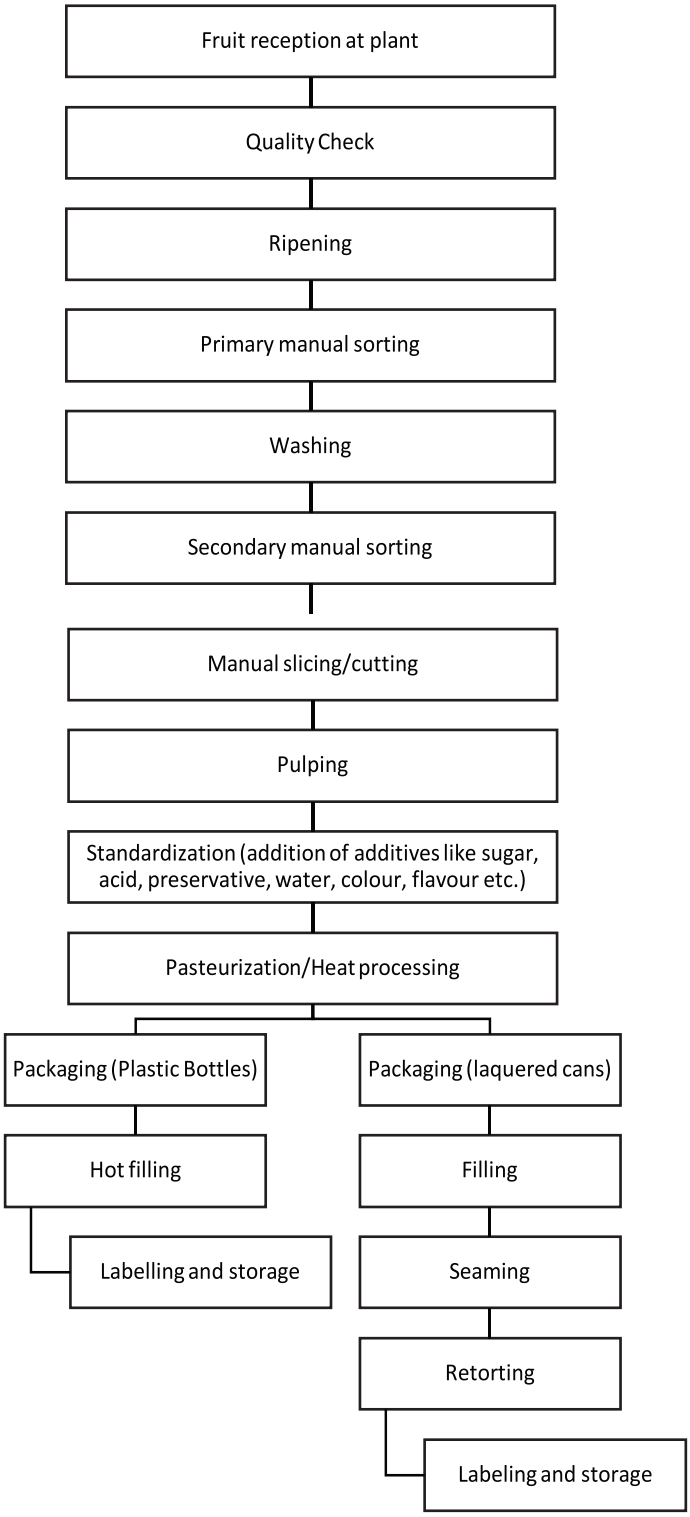
(2) Washing of Fruits

Table 2 shows the methods of washing the fruits before processing. Here, it can be observed that 99% of the fruits are being washed by automatic fruit washing units. Automatic unit washes the fruits using spray jets and bubbling action, which removes all the extraneous matter from the fruit surface effectively. Out of the total industries visited, 63% plants have installed such fruit washing units, while 38% plants are washing fruits manually.

Table 2. Method of Washing Being Used in Processing of Fruit Pulp and Beverages in Gujarat

S. No.	Type of Washing	Number of units	% of units	Approximate Quantity of Fruits Processed Per Annum MT (Metric Tonnes)	% of Total Fruits Processed
1	Manual	9	38	408	1
2	Automatic washer with spray jets and bubbling	15	63	51085	99
	Total	**24**	**100**	**51493**	**100**

Figure 2. General Process Flow Chart Followed by Organizations for Processing of Fruit Pulp and Beverages



(3) Fruit Pulping and Finishing

Pulping is the key processing step that decides the quality, fineness, and smoothness of the end product (fruit pulp). Types of pulping machines installed by different industries are shown in Table 3. It has been observed that majority (75%) of the industries possess two stage pulping units (stage 1- pulp extractor, stage 2-pulp finisher) while single stage pulpers were possessed mainly by cottage sector units. For pulping of 99% of the total fruits procured, two stage pulping units are used. These pulping units are generally made up of motor driven shaft with plastic wire brushes, and stainless steel screens (sieve size: stage 1 – ¼ inches, stage 2 – 1/32 inches).

Table 3. Type of Pulping Unit Being Used in Processing of Fruit Pulp and Beverages in Gujarat

S. No.	Type of Pulper	Number of Units	% of units	Approximate Quantity of Fruits Processed per Annum (MT)	% of Total Fruits Processed
1	Single stage	6	25	283	1
2	Two stage with finisher	18	75	51210	99
	Total	**24**	**100**	**51493**	**100**

(4) Heat Processing

Heat treatment to the fruit pulp is given to kill pathogens as well as to destroy enzymes which can deteriorate the pulp very quickly. Heat treatment/pasteurization is common for all types of fruit; the type of heat exchanger used differs according to the type of fruit, capacity of plant etc. Out of 24 industries visited, 22 industries (92%) are giving heat treatment to the product, while remaining 2 industries directly freeze the pulp or pieces of fruits. As shown in Table 4, approximately 54% of the industries have installed spiral type tube-in-tube heat exchanger for continuous pasteurization of pulp/beverages, while 29% of the plants are using steam jacketed kettles for heating batches of pulp/beverage.

Table 4. Type of Pasteurization Equipment Being Used in Manufacture of Fruit Pulp and Beverages in Gujarat

S. No.	Type of Pasteurizer	Number of Units	% of Units
1	Spiral type tube-in-tube heat exchanger	13	54
2	Steam jacketed kettle	7	29
3	Scrap surface heat exchanger	1	4
4	Direct flame	1	4
5	No heat treatment given	2	8
	Total	**24**	**100**

(5) Packaging of Pulp/Beverages

Table 5 shows different types packaging materials being used for packaging fruit pulp/beverages. Approximately 63% of the products are being packed in lacquered steel cans of different sizes viz. 850 g, 3.1kg, and 5.2 kg. Mainly all

Table 5. Type of Packaging Materials Being Used for Packaging of Fruit Pulp in Gujarat

S. No.	Type of Packaging	Number of Units	% of Units
1	Lacquered can	15	63
2	Plastic bottle	5	21
3	Glass bottle	2	8
4	Aluminium laminate	1	4
5	Bulk container	1	4
	Total	**24**	**100**

the fruit pulps are packed in lacquered cans because of feasibility of in-can-sterilization or retorting after packaging. Fruit crushes are generally packed in plastic/pet bottles. The share of plastic bottles is approximately 21% while that of glass bottles is approximately 8%. The industries directly freeze the pulp after extracting use bulk containers or large aluminum laminates as packaging materials. Approximately 71% of the industries use in-can/in-bottle sterilization for pulp/beverage.

(6) Plant Utilities

The industry dealing with processing of fruit pulp generally requires plant utilities like electricity, compressed air, hot water and steam, and effluent treatment plants.

(7) Boiler

As shown in Table 6, approximately 88% of the industries have installed boiler, while 12% plants don't possess boiler facility. Generally, cottage to small type of industries have installed non-IBR boilers, while small to large type of industries have IBR (Indian Boiler Regulations) boilers. The capacity of the boilers installed in the industries range from 2kg/h (kilograms per hour) to 6T/h (tonnes per hour).

Table 6. Type of Boiler Installed in Fruit Pulp and Beverage Industry in Gujarat

S. No.	Type of Boiler	Number of Units	% of Units
1	Non IBR boiler	10	42
2	IBR boiler	11	46
3	No boiler installed	3	12

(8) Effluent Treatment Plant (ETP)

Approximately 63% of the industries have Effluent Treatment Plant for treating waste water from the processing (Table 7). The ETP plants installed have capacities ranging from 400 to 20,000 l/h (litre per hour) with an average capacity of 9426 l/h.

Table 7. Effluent Treatment Plants Installed in Fruit Pulp and Beverage Industry in Gujarat

S. No.	Effluent Treatment Plant	Number of Units	% of Units	ETP Plant Capacity (l/h) Average	ETP Plant Capacity (l/h) Range
1	Installed	15	63	9426	400 - 20,000
2	Not installed	9	38	-	-
	Total	**24**	**100**		

Constraints Faced by the Industry

As discussed earlier, the fruit processing sector is seasonal and during the peak season, the man power requirement greatly increases. The industry is in a developing stage and it is facing some major problems like manpower shortage,

Table 8. Major Constraints Faced by Fruit Pulp and Beverage Industry in Gujarat

S. No.	Constraint Faced	Number of Units	% of Units
1	Seasonal man power shortage	20	83
2	Government taxes	22	92
3	Government certification procedures	15	63
4	Raw material availability	2	8
5	Raw material quality/ defects	3	13
6	Product quality/ defects	0	0

complications in governmental certification procedures, and government taxation problems. As shown in Table 8, 92% units are having problems with government taxation system, the systems are complicated, and less transparent according to them. The penalties are high and guidance and support is least from the government. Raw material availability is also a problem for 8% of the industries, while no industries showed problems in product quality related constraints.

Conclusion

The majority of the fruit pulp and beverage manufacturing industries in Gujarat are located in two regions, mainly South Gujarat and Saurashtra. Various type of fruits such as mango, guava, grape, black-jamun, pineapple, pomegranate, star fruit, papaya, orange, strawberry etc., are being processed for pulp, crushes, and juices. Approximately 56% industries are manufacturing mango pulp, which account for 92% of the total installed plant capacity. Mangoes are procured during March-July and the quantity per industry ranges from 11-10000 MT per season with accumulative average of 2220 MT/season. Before processing, approximately 99% of the fruits are washed in automatic fruit washers while only 1% fruits are washed manually. Except some cottage scale industries, 63% industries have installed automatic fruit washers. The sorting operation is done 100% manually by the pulp and beverage industries. The pulping of 99% of fruits is carried out by 2 stage pulping machines. Such machines are available with 75% of the pulp and beverages industries. Approximately 98% industries give heat treatment to the pulp/beverage before packaging, and out of this, 54% industries are using spiral type tube-in-tube heat exchangers for heating the pulp/beverage. For packaging of pulp, lacquered cans are the first choice of 63% of industries, while 21% industries are using plastic bottles as packaging material for fruit crushes/juices. Utilities like boilers and ETP are installed with 88% and 63% of the industries respectively. Approximately 92% industries showed government taxes as the biggest constraints for the industry, while 83% industries face problems of seasonal manpower shortage. None of the industries declared any product quality defect as their constraint.

Implications

The research brought about many unknown things and facts about the present condition of the fruit pulp and beverage industry in Gujarat. The current paper can be helpful to the researchers, industrialists, common man, and more specifically to the policy makers in many ways. Presently there is no such concise information about the food industry with any government organization. Thus, this survey can be easily taken as a reference for making important decisions regarding the food industries, specifically in the selected sector.

Limitations

The food industry in the selected sector is still in small to cottage scale. There are difficulties in operation and technical manpower employment, due to less production capacities and turn over. The lack full hand technical support, the industry mainly runs on traditional methods, there is a lack of research and development, and innovative approach at the industry level. The approach of the industry when the survey was done was quite conservative, and it tried to hide some of the data, which can improve the survey report more on the technical side.

Scope for Further Research

The present data comprises of all the major industrial and technical information pertaining to the selected food sector. There is a huge scope for conducting similar case studies for other food processing sectors in Gujarat and coming out with a complete book on the food industry of Gujarat, enveloping all the techno-industrial capabilities and short hands with the state for food processing. There is also much scope for conducting further research in underutilized fruit crops, so that the industries can get technology for processing them and getting their plants running throughout the year at fullest capacities, which is the biggest problem at present.

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