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Postharvest Management, Processing and Marketing of Jackfruits

Jackfruit (*Artocarpus heterophyllus* Lam.), the national fruit of Bangladesh, is one of the most common, important and delicious fruits in the country. Both the pulp and seeds of ripe jackfruit are rich sources of carbohydrate, vitamins and minerals, and, thus, jackfruit is highly nutritious. Also, green jackfruit is popular in Bangladesh as a delicious vegetable dish. However, because

of a lack of postharvest processing and management technologies, a staggering 30-35% loss of jackfruit occurs which costs about Tk. 500 crore per annum. With improved postharvest management and processing technologies to produce canned fruit, dried fruit and pulp, jackfruit jam, dehydrated jackfruit, chips, etc. and sound marketing this national fruit of Bangladesh can contribute significantly to improvement of food security and income generation for the people and export earnings for the country. This KGF sponsored project was designed to



Fig. 1. Ripe jackfruit: Delicious, but also wasted in large quantities

develop improved methods of postharvest management and processing technologies and devise strategies and plans for profitable marketing of fresh and processed jackfruit products.

Methodology

A baseline survey was conducted to evaluate the present status of jackfruit production, postharvest management and processing. Immature jackfruit (6-7 weeks) was considered for fresh-cut, ready-to-cook, frozen and pickles and matured Gala type jackfruits were used for processing fresh-cut, jam and leather. Similarly, matured *Khaja* type jackfruits (golden yellow flesh) were utilized to prepare dehydrated chips and seed powder. The research team of the Post-Harvest Technology Division of BARI developed jackfruit chips, fresh-cut/vegetable meat, frozen jackfruit, dehydrated jackfruit, jackfruit jam, ready-to-cook (RTC), seed flour, jackfruit leather, pickle and more than 10 recipes of preparing snack items from jackfruit such as, *singara*, *samucha*, vegetable roll, cutlet, sandwich, burger, *papads*, cheese, ice-cream and yogurt. Nutritional quality parameters of these food items such as, contents of minerals, vitamins, bioactive compounds were determined, antioxidant activities were studied and sensory evaluation during storage was done. For storing and marketing of jackfruit products, two packets were designed and fabricated.. For evaluation of marketing strategies, the



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collaborating NGO, New Vision Solutions Limited (NVSL) conducted several surveys in the project areas. Consumer surveys were conducted using two survey tools such as face-to-face (F2F) interviews and focus group discussions (FDG) in Dhaka, Rajshahi and Chattogram divisions and personal observations of the team members to develop market and value chain of jackfruit. Promotional, awareness creation and motivational activities were conducted at 40 different locations through appraising audiences about the health benefits of jackfruit and disseminating information on jackfruit processing techniques in Dhaka, Chattogram, Rajshahi, Mymensingh and Rangpur regions and parts of three other districts (Khagrachari, Tangail, and Gazipur).

Results and Outputs

Jackfruit production and marketing

Consumer surveys indicated that 38% of consumers liked jackfruit to a great extent and 58% of them liked Khaja type jackfruit. About 68% of the consumers bought jackfruits from the nearest vegetable/fruit market. Among the consumers, 40% were not aware of the health benefits of jackfruit and 68% had no idea about processed or value-added jackfruit products. Most of the consumers would like to see jackfruit chips and fresh-cut jackfruit available in the market.

The global market size of jackfruit and its value-added products was estimated to be around \$350 million. The major shares of the international market would be the Asia-Pacific region (37%) followed by Europe (23%) and North America (20%).

The present supply chain of the jackfruit market in Bangladesh is quite complex (Fig. 2). Jackfruit needs to be quickly brought to markets after harvest. The farmers/growers usually sell their products to *beparies*. Almost 88% of the products are sold through *beparies*. Sometimes farmer/growers sell their products directly to *forias*, wholesalers or retailers. Some small farmers also sell their jackfruits by themselves in the market to consumers. *Beparies* sell most of the products to *aratdars* or directly to wholesalers and retailers. *Aratdars* in exchange for a commission deliver products to wholesalers and retailers. Finally, through the retailers jackfruit reaches consumers' hands. Marketing cost is an important cost component.

The survey revealed that, approximately 43.9% of the total jackfruit production, i.e., about 4.56 million tons went to waste in 2019-20. When post-harvest losses were accounted for, the return on investment (ROI) was substantially reduced for all intermediaries. For example, the retailers would have their ROI reduced from 11.8% to 6.72%. In most cases this waste was due to improper storage resulting in rotting of the ripe jackfruit. The major challenges in jackfruit marketing were found to be poor storage and transportation facilities, extortion, and lack of government support.

Post-harvest value addition

Several value-added jackfruit products such as, fresh-cut, jam (Fig. 3), dehydrated, freeze dried, vacuum fried chips, leather, ready to cook products, pickles, frozen, seed powder and roasted seed were prepared and packets (63-65 µm thick for four layers including print ink, 19-21 mm long and 15.5-16.5 mm wide) for their marketing were designed and fabricated (Fig.

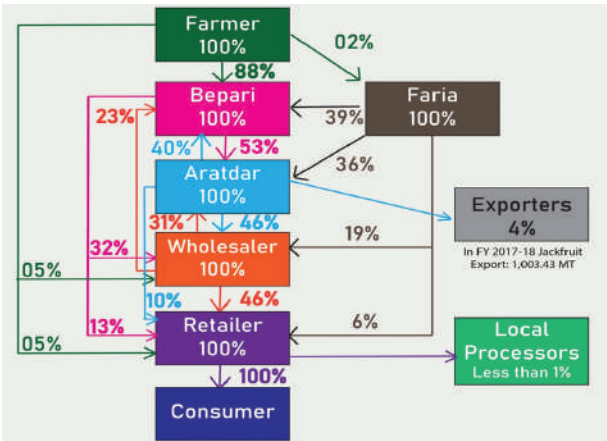


Fig. 2. The jackfruit supply chain



Fig. 3. Steps in the preparation of jackfruit jam (from top left to bottom right: Ripe fruit, de-seeding, blending, pulp making, jam preparation, sterilization of glass bottle in hot water, filling glass bottles with jam, storage of jam-containing glass bottles in ambient temperature)

3). These products exhibited good nutritional quality with considerable amounts of different bioactive compounds like total phenols, carotenoids, beta-carotene, ascorbic acid and significant antioxidant activity. Furthermore, consumers' perception indicated an excellent sensory quality of the processed products. Low-temperature storage (3-6oC) of fresh-cut tender jackfruit prolonged the shelf life (3 days) and improved edibility. Fresh-cut ripe jackfruit prepared using 0.6% CaCl₂ could be stored for up to 6 days by maintaining a temperature of 2±1oC. Jackfruit jam prepared using 10% lemon juice showed high nutritional quality and sensory acceptance. The sugar concentration of 50o brix was found to be the best option for preparing dehydrated jackfruit. Lemon juice (7-10%, v/w) could be added to jackfruit pulp during

preparation of leather, which could boost up different nutritional compounds. Freeze drying at -56oC and cabinet drying at 60oC maintained good nutritional quality of jackfruit seed powder retaining its bioactive compounds and antioxidant properties. Frying at 110°C for 25 minutes and at 120°C for 20 minutes made good quality jackfruit chips with adequate nutritional and sensory properties. Tender jackfruit pretreated with 0.3% citric acid (CA) + 0.3% potassium metabisulfide (KMS) + 1% CaCl₂, 0.3% arachidonic acid (AA) + 0.3% KMS + 1% CaCl₂, and 0.3% AA + 0.3% KMS + 0.3% CA + 1% CaCl₂ could be stored in a frozen condition (-10oC) for longer storage (>6 months) without appreciable quality change. Raw jackfruit chips coated with 10% maltodextrin and dried in a freeze-drier could be stored with acceptable quality. Jackfruit seed roasted in a vacuum fryer boosted its overall acceptance by the consumers. More than 10 recipes of jackfruit by-products such as, jackfruit pickle, chutney, juice, cutlet, singara, samucha, vegetables roll, sandwich, burger etc. were prepared.

Business and entrepreneurship development

Four marketing alternatives were identified, and a Grower/Entrepreneur Business Model was developed (Fig. 4). The model focuses on the following segments in jackfruit business: key partners, key activities, key resources, customer relationships and distribution channels.

Eight farmers groups, entrepreneurs and small and mid-size enterprises (SMEs) at eight locations in the project areas were formed. BARI and NVSL jointly provided hands on training to 16 batches (20 participants/batch) of small and medium scale processors and entrepreneurs from the project areas for the preparation and marketing of

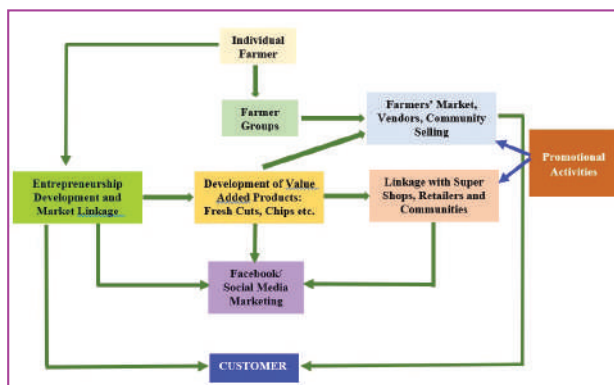


Fig. 4. Proposed business model for jackfruit marketing

jackfruit products. Different promotional and motivational activities were conducted to highlight the health benefits of jackfruit and promote post-harvest processing of jackfruit. Sixteen entrepreneurs from different project areas prepared jackfruit products and sold to consumers during the promotional activities of the project. Successes came from Meena Bazar, a chain superstore, and weekend 'Krisoker Bazar' in the Dhaka city. Besides, many consumers in Dhaka, Chattogram, Cumilla, Tangail, Mymensingh and Khagrachari purchased assorted jackfruit products from the trained jackfruit entrepreneurs. Information was also disseminated through print and electronic media. Four regional workshops were conducted in Rajshahi, Mymensingh, Chattogram and Khagrachari participated in by farmers, traders, SMEs, different government and non-government organizations for initiating and strengthening marketing and technology transfer. In addition, certain export market explorations were successfully done through sending jackfruit product samples to USA, Germany, Middle East etc. Different feedbacks and suggestions such as superior quality packaging, strong supply chain management to ensure continuous supply, quality control etc. were received in respect of improving jackfruit products and their marketing.

Expected Impact

The project work revealed that, with improved post-harvest management and processing technologies, good quality, delicious and nutritious value-added products like canned fruit, dried fruit and pulp, jam, chips, etc. can be prepared from jackfruit, the national fruit of Bangladesh. This can reduce jackfruit wastage which is almost half of the total production, and, thus, contribute to the improvement of food security and income generation for the people and export earnings for the country. The findings of the project would be helpful in promoting sustainable entrepreneurship positively impacting rural communities by creating jobs and supporting community development.

Recommendations

The project scientists recommended several steps like new variety development, fruit bagging, preservation facility development, incentive packages for farmers and growers and policy reformation to increase jackfruit production, minimize wastage and enhance profits. Quality research should be continued in an attempt to develop improved methods of post-harvest management and processing technologies and devise strategies and plans for profitable marketing of fresh and processed jackfruit products.

This technical bulletin has been prepared on the basis of technical information available from a completed BKGET-KGF Funded CGP Project the details of which are given below:

Project Code and Title: TF 65-C/19. Post-harvest Management, Processing and Marketing for loss Reduction and Value Addition of Jackfruit

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