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Empowerment of Rural Tribal Women through Value Addition of Carambola

Y. Prabhabati Devi[1], Khwairakpam Bembem[2*] and Th Bidyalakshmi Devi[2]

[1]ACTO, Home Sc. KVK, Chandel, ICAR, Manipur Centre, India.
[2]Scientist, ICAR-Central Institute of Post-Harvest Engineering & Technology, Ludhiana, Punjab, India.

Authors' contributions

This work was carried out in collaboration among all authors. Author YPD designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Authors KB and TBD managed the analyses of the study. Author KB managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Carambola is one of the highly perishable underutilized fruit wildly available in the hillocks of Chandel district which goes wasted every season. In order to reduce the post-harvest losses, *Krishi Vigyan Kendra* (KVK), Chandel took initiative to convert the underutilized carambola in to value added products. For this study, primary and secondary information were collected in order to assess the indigenous knowledge for the preparation and consumption of different carambola products. Five value added products namely, carambola squash, ready to drink juice, jam, candy and salted preserves were standardized. Rural tribal women were empowered through training and demonstrations on the preparation of value added carambola products. *Lamjing* Shelf Help Group (SHG) was formed by a group of women and started an enterprise on processing and value addition of carambola. The standardized products were organoleptically tested for acceptability before marketing. Value added products were sold at the local *mela*s and markets enabling SHG members to generate additional income and making them financially empowered.

**Corresponding author: E-mail: bembemkhwai@gmail.com;*

Keywords: Carambola; underutilized fruit; post-harvest; value addition; women empowerment.

1. INTRODUCTION

Carambola, popularly known as star fruit is a fleshy, attractive fruit widely grown in tropical countries. Star fruit belongs to the oxalidaceae family and genus *Averrhoa*. The word 'carambola' is derived from the Sanskrit word '*karmaranga'* meaning 'food appetizer' [1]. It is edible both as processed and as table fruit. The ripe fruit may be process into fermented or unfermented drinks, jam or jelly and can be eaten fresh or as dessert [2]. It is a juicy fruit with predominantly yellowish green in appearance with a succulent pulp when riped, having high functional and nutraceutical potential [3]. Carambola is a potent natural antioxidant fruit with phenolic contents [4]. It grows wildly in the hillocks of Chandel district of Manipur which remain underutilized. It is a highly perishable fruit once it attains maturity and ripens. Due to lack of storage facility and knowledge on processing, preservation and value addition, a huge amount of fruits are wasted every year. Carambola fruit have limited marketability because of high perishability and high moisture content which lead to the extensive postharvest losses [5]. Fruits have to be preserved fresh or processed to reduce the loss and wastage after harvest. Drying and value addition in the form of squash, ready to drink (RTD) juice, jam, pickle, candy and salted dry preserve could extend the shelf life and make it available throughout the year. To tackle the problem of wastage, *Krishi Vigyan Kendra* (Agricultural Science Center), Chandel took initiative for the promotion of processing and value addition of carambola. By processing and value addition of carambola, post-harvest losses can be reduced from 25% to 75% [6]. Development of such food products are also low cost venture as high end sophisticated technology and equipment are not be required. Thereby, it could reach population who are below poverty line as well, providing them avenue for starting small enterprise on processing of carambola which can empower them by enhancing income generation and improving livelihood. The main aim of this study was to develop different value added products of carambola and also to empower tribal women through enterprise on different post harvesting processing of carambola.

2. MATERIALS AND METHODS

Matured and ripened carambola fruit were collected from the hillocks of Chandel district of Manipur state, India. Fifteen elderly people who were aged more than 60 years were interviewed on the use and preparation of different products from carambola. Recipe and method of preparation were standardized using laboratory scale trials and bench top sensory analysis.

Recipe for carambola squash, ready to drink (RTD) juice, jam, sweet and salted candies were standardized. Storage studies conducted by Monalisa and others [7] showed that carambola jam and squash can be stored for 3 months without any change in quality.

2.1 Production of Carambola Squash

For the preparation of carambola squash; fresh sound fruits were selected, weighed and washed properly with cold water. The fruit were cut and sliced into five to six parts and trimmed to remove seed, fibre and upper ribs. Fruit slices were crushed in juice extractor and the juice was strained using muslin cloth. Sugar, citric acid, juice and potassium metabisulphite (KMS) were weighed as required. Sugar syrup was made by boiling sugar, citric acid and water, then filtered using muslin cloth. The syrup was then mixed with the pasteurized juice and then KMS was added to the squash and mixed properly. Finally the squash was cooled and poured into sterilized bottle and sealed properly. Formulation and flow sheet for preparation of carambola fruit squash is given in Table 1 and flowsheet 1, respectively.

2.2 Production of Ready to Drink (RTD) Carambola Juice

For the production of RTD carambola juice, healthy matured fruit were selected. Fruits were washed and trimmed to remove seed, fibrous part and ribs. Juice was extracted by using juice extractor and the juice was filtered using a strainer. Sugar, citric acid and water were added and heated to boil which was then strained through a filter. The syrup was cooled and mixed with the juice and remaining water and mixed thoroughly. Then KMS was dissolved in small quantity of water and added to RTD juice. After mixing properly it was finally poured into sterilized bottle. Formulation for preparation of carambola fruit squash is given in Table 2 and flow sheet is the same as for the preparation of

squash. However, the amount of the ingredients was different from the RTD juice.

Table 1. Formulation of Carambola fruit squash

Ingredients	Amount
Carambola juice	1 litre
Sugar	1 kg
Citric acid	5 g
KMS	2 g
Water	500 ml

Table 2. Formulation of carambola fruit RTD juice

Ingredients	Amount
Carambola juice	1 litre
Sugar	1.5 kg
Water	6 litre
Citric acid	5 g
KMS	2 g

2.3 Production of Jam

Fresh and matured fruits were selected for preparation of jam. The fruits were weighed and washed thoroughly in tap water. Washed fruits were cut into small pieces. The pulp were extracted using pulp extractor. The extracted pulp was cooked by adding 750 g sugar till it became slightly thick in consistency. 10 gram of citric acid was added and cooked till it reached to jam consistency or a total soluble solids (TSS) of 68°B. Few (3-5) drops of yellow food colour was added to the cooked jam and filled into the sterilized glass bottle and sealed properly. It was then cooled and stored it in a cool and dry place. Formulation for the preparation of carambola jam is given in Table 3.

Table 3. Formulation of carambola fruit Jam

Ingredient	Amount
Carambola pulp	1 kg
Sugar	750 g
Citric acid	5 g
Yellow color	Few drops
Pectin (optional)	10 g

2.4 Production of Candy

Fresh and matured carambola fruits were selected and washed properly with cold water for the preparation of candy. Fruits were pricked by using stainless steel fork to facilitate penetration of sugar inside the fruit. Sugar syrup of 50 percent TSS was prepared and the fruit was soaked in the syrup overnight. The syrup was drained the next day and its strength increased to 60°B. The process was repeated till the strength of the syrup became 72°B. The thick syrup was drained and the carambola pieces were dried under shade at ambient condition. After drying, the candies were coated with sugar powder. The candied carambola were stored in sterilized dry bottle. Formulation for the preparation of carambola candy is given in Table 4.

Table 4. Formulation of carambola fruit candy

Ingredient	Amount
Carambola fruit	1 kg
Sugar	1.25 kg
Sugar powder	100 g

2.5 Production of Salted Dry Preserve

Fresh and matured carambola fruits were selected and washed properly with cold water for the preparation. Fruits were cut into pieces of 1 cm in diameter to facilitate penetration of salt. Fruit pieces were cured with salt and kept overnight. Excess water were drained out the next day. The cured fruit pieces were properly mixed with red chilli powder in a stainless steel sauce-pan and dried in sunlight. Fruit pieces were turned to facilitate drying. Dried preserves were stored in sterilized dry bottle. The product was then packed in sachet or pouch and labelled it properly before marketing. Formulation of carambola salty preserve is given in Table 5.

Table 5. Formulation of carambola salted dry preserve

Ingredient	Amount
Carambola fruit	1 kg
Salt	100 g
Red chilli powder	10 g

2.6 Sensory Evaluation

The products were evaluated by a panel of 10 semi-trained panelist to test the acceptability of the product before marketing. The panelists were selected from women entrepreneurs of Imphal, Manipur. Sensory attributes for characteristic colour, flavour, texture, taste and overall acceptability of the products were scored in a nine point hedonic scale. The standardized recipes were analyzed for acceptability by a panel of judge using the nine point hedonic scale

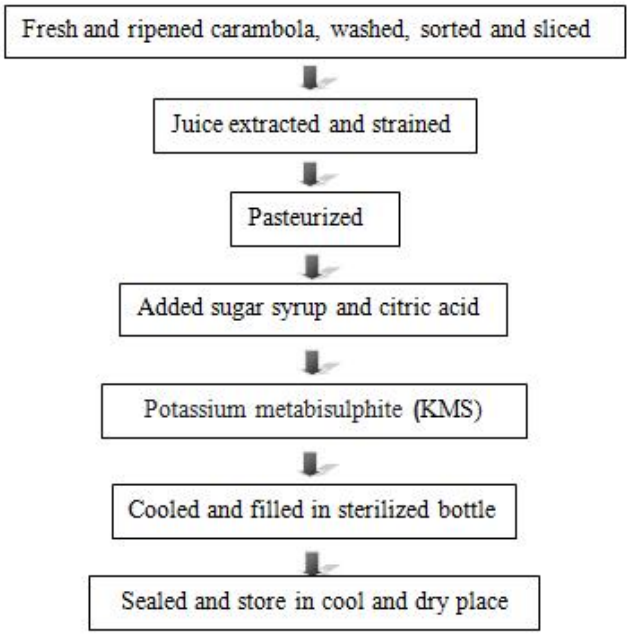

Fig. 1. Flowsheet for the preparation of carambola squash

as described by Joshi [8]. Mean scores for each parameter was reported. The scores represented 1 = dislike extremely, 2 = dislike very much, 3 = dislike moderately, 4 = dislike slightly, 5 = neither like nor dislike, 6 = like slightly, 7 = like moderately, 8 = like very much and 9 = like extremely.

3. RESULTS AND DISCUSSION

On interviewing the elderly locals aged >60 years on the use of carambola fruits, it was informed that the fruits were mostly consumed fresh, juiced and dried.

Women in India are the victims of multiple socio–economic and cultural factors [9]. The main activities of the rural tribal women for sustaining livelihood were craft work, paddy cultivation, fire wood collection, charcoal making, rearing livestock and selling of locally available fruits and vegetables etc. To empower tribal women of Chandel district of Manipur, skill development training and demonstration on processing and preservation of locally available underutilized fruits including carambola were conducted by KVK Chandel. Training increased the knowledge of farmers [10] and is also one of the important aspects of empowerment [11]. Earlier studies by Dumas [12] has also indicated that training empowered participants to start achieving economic self-sufficiency, help them start to build strong business and life management skills, may have influence on the growth of business and generate employment. Exposure visit and field day were organized to motivate the women to start the enterprise and familiarize them with the art of processing, production, packaging technique and development of markets. After attending these programmes, 10 tribal women from *Khangsim* village of Chandel came together to form *Lamjing* self-help group and started a small enterprise on processing of carambola. They started producing carambola squash, RTD juice, jam, candy and salted dry preserve. Fig. 2 is the photograph of fresh carambola fruit and members of the *Lamjing* SHG with the carambola products. All the products received good sensory scores as shown in Table 6.

The products were mostly sold in local market and neighbouring markets, like Imphal market and also sent to other states. For popularization of their product and also for selling the product, the SHG has participated in the farmers' fair, exhibition organized by Indian Council of Agricultural Research, Central Agricultural University, Agricultural Technology Management Agency, state government, regional agricultural fair, *Saras mela*, *Sangai* festival, which were held in the state. On an average, the *Lamjing* SHG participated in about 5-7 fairs annually.

After intervention and formation of SHG, members were earning additional income from the sale of value added products without spending much money as seasonal fruits such as carambola were available underutilized. Their monthly sales for different carambola products are shown in Table 7. The annual sales and profits are also given in Table 8.

Table 6. Mean sensory score of various products of Carambola

Name of the products	Sensory attributes				
	Colour	Flavour	Texture	Taste	Overall acceptability
Carambola squash	7.0	7.5	-	7.2	7.2
Carambola RTS	7.2	7.1	-	7.4	7.0
Carambola jam	7.3	7.6	7.5	7.2	7.4
Carambola candy	7.6	7.4	7.5	8.5	8.2
Carambola salted dry preserve	7.3	7.8	7.6	8.2	8.0

Fig. 2. (a) Carambola fruit and (b) members of *Lamjing* SHG with carambola products

Table 7. Month wise sale of processed and value added carambola product

Product	Monthly sale (numbers/packets)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Carambola Candy (100 g pkt)	120	300	400	250	100	150	200	1000	1500	200	150	300
Carambola dry salted preserve(100 g pkt)	150	250	350	200	150	120	180	2000	3500	400	350	380
Jam (100 and 200 g)	120	150	320	250	170	150	125	2500	3000	250	180	250
Carambola RTS (200 ml)	200	150	2000	1000	500	350	3000	5000	7000	1500	500	300
Carambola squash (200 ml)	-	-	150	120	100	250	340	1000	2000	300	150	50

Table 8. Monthly sales realization of the SHG (Rupees in thousand)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Gross Income	10.0	20.0	35.0	18.8	15.7	20.5	18.5	20.8	28.4	35.1	18.0	20.0
Net Income	4.5	14.2	20.6	11.5	8.2	11.0	9.7	12.2	18.6	22.1	10.2	12.5

Members of the *Lamjing* SHG were financially empowered with increased income as shown in Table 8. On interacting with the members, they expressed that their financial conditions has improved and thus could purchase television and new furniture. The SHG members also stated that they were also able to include more nutritious food item in their diet and could improve children's educational quality. In recent years, studies have shown that improvement in household welfare depend not only on the level of household income, but also on who earns the income. These studies found that women tend to spend their income disproportionately on food for the family relative to men and are more strongly associated with improvements in children's health and nutrition status [13]. The members felt socially empowered, more self-reliant, increased social participation, improved status of the family in the society and increased acceptability among fellow members. Similarly, Singh [9] in his study stated that SHGs have not only produced tangible assets and improved living condition of members but also help in changing much of their outlook, worldview and attitude, which holds true for the members of *Lamjing* SHG. It could be seen that tribal women of *Khangshim* village of Chandel district of Manipur state were empowered through the trainings delivered and motivation for formation of SHG as reported by other authors [14,15,16].

4. CONCLUSION

Post-harvest loss of carambola fruit, which remain underutilized in Chandel district of Manipur state, India were reduced through processing and value addition. Tribal women of the district were trained for processing and value added products of carambola viz. carambola squash, ready to drink juice, jam, candy and salted preserves. They were benefited from the initiative taken up by KVK Chandel in promoting the processing and value addition of carambola fruit. Trainings and demonstrations conducted by the KVK empowered participants to begin entrepreneurial activities and improved their living conditions from the additional income generated. Likewise, more numbers of tribal women can be empowered through such income generating activities by processing locally available underutilized fruits and vegetables. Additionally, skills and technologies should be updated from time to time to meet the market demand to occupy a competitive space in the bigger market.

CONSENT

As per international standard or university standard, Participants' written consent has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Manda H, Vyas K, Pandya A, Singhal G. Complete review on: *Averrhoa carambola*. World J Pharm Pharm Sci. 2012;1(1):17-33.
2. Patil AG, Patil DA, Phatak AV, Chandra N. Physical and chemical characteristics of carambola (*Averrhoa carambola* L.) fruit at three stages of maturity. Int J Appl Biol Pharm Technol. 2010;1(2):624-9.
3. Zainudin MA, Hamid AA, Anwar F, Osman A, Saari N. Variation of bioactive compounds and antioxidant activity of carambola (*Averrhoa carambola* L.) fruit at different ripening stages. Scientia Horticulturae. 2014;172:325-331.
4. Dasgupta P, Chakraborty P, Bala NN. *Averrhoa carambola*: An updated review. Int J Pharm Res Rev. 2013;2(7):54-63.
5. Gol NB, Chaudhari ML, Rao TR. Effect of edible coatings on quality and shelf life of carambola (*Averrhoa carambola* L.) fruit during storage. J Food Sci Technol. 2015;52(1):78-91.
6. Devi YP, Roy SS, Devi YI, Kabui GP, Prakash N. Delights of fruits and vegetables. ICAR Research Complex for NEH Region, Manipur Centre, Lamphelpat, Imphal. 2013;168.
7. Monalisa K, Islam MZ, Asif-Ul-Alam SM, Hoque MM. Valorization and storage stability assessment of underutilized fruit carambola (*Averrhoa carambola*) in Bangladesh. Am J Food Sci Technol. 2014;2(4):13413-8.
8. Joshi VK. Sensory science: Principles and applications in evaluation of food. Agro-Tech Publishers, Udaipur. 2006;527.
9. Singh Y. Effect of self-help group in economic empowerment of rural women in Himachal Pradesh. J Ind Res. 2013;1(3):54-61.
10. Shahi V, Shahi B, Kumar V, Singh KM, Kumari P. Impact study on mushroom cultivation for micro

entrepreneurship development and women empowerment. J Pharma Phytochem. SP4. 2018;1-4.
11. Jadav SJ, Rani VD, Mudgal S, Dhamsaniya HB. Women empowerment through training in dairy farming. Asian J Dairy Food Res. 2014;33(2):147-53.
12. Dumas C. Evaluating the outcomes of microenterprise training for low income women: A case study. J Dev Entre. 2001;6(2):97.
13. Quisumbing AR, Brown LR, Feldstein HS, Haddad L, Peña C. Women: The key to food security. Food Nutr Bull. 1996;17(1): 1-2.
14. Uma N. Self help group: An effective approach to women empowerment in India. Int J Soc Sci Interdiscip Res. 2012;1(8):8-16.
15. Nagaraja N, Kongalappa HS. A Study on women empowerment through Self-Help Groups. Int J Eng Manag Res. 2014; 4(6):176-81.
16. Agarwal P, Mathur P. Self Help Groups: An exogenous women empowerment strategy in India. Kasetsart J Soc Sci. 2019;40(3): 756-61.

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